Project Schedule and Public Involvement Plan M1

Needs and Opportunities M2

Identification of Alternatives M3

Evaluation of Alternatives M4

Regional Commuter Rail/High-Capacity Transit Plan M5

Final Report M6

MILESTONE 1
PROJECT SCHEDULE AND PUBLIC INVOLVEMENT PLAN

Feb. 2002

HIGH-CAPACITY TRANSIT PLAN

Maricopa Association of Governments

HIGH-CAPACITY TRANSIT PLAN

Maricopa Association of Governments

MILESTONE 1

PROJECT SCHEDULE
AND PUBLIC INVOLVEMENT PLAN

1.0 Executive Summary

This Milestone Report is the first of six documents which will be prepared for the Maricopa Association of Governments (MAG) High Capacity Transit Plan. Contained within the Milestone 1 report are the results of the first three project tasks:

- Task 1: Refine Scope of Work
- Task 2: Develop Public and Agency Involvement Plan
- Task 3: Review Prior Studies and Conduct Review of High Capacity Transit Characteristics

The High Capacity Transit Plan study effort is being undertaken by MAG to identify possible transit corridors in the Phoenix metropolitan area and propose effective transit technologies capable of serving these corridors. Commuter rail is being examined for implementation in existing freight rail corridors. Other high capacity transit services such light rail transit (LRT) and bus rapid transit (BRT) will be identified for rail corridors where commuter rail cannot be implemented or in areas not located near a rail corridor.

Public input will be essential for the success of this study. A public involvement plan (PIP) has been prepared, detailing the public outreach efforts which will be part of this study effort. This document is contained within this report.

A detailed schedule is included in Milestone 1, as well as a review of other transportation studies in the MAG region, and a comparison of the characteristics of high-capacity transit technologies.

Milestone 1 has been divided into the following sections:

- 1.1 Scope of Work and Project Management Plan
- 1.2 Public and Agency Involvement Plan
- 1.3 Review of Transportation Studies
- 1.4 High Capacity Transit Characteristics

The revised Scope of Work for the project is included as an Appendix located at the back of the Milestone 1 Report.

1.0.1 Project Management Plan

The purpose of the Project Management Plan is to communicate the objectives of the MAG High Capacity Transit Study to all of the Consultant Team participants. It presents the overall management strategy and the responsibilities, authorities, and procedures guiding the various portions of the project.

The Project Management Plan is a framework. It provides a structured approach to completing the defined tasks of the project. Managers and staff implementing the Plan will provide additional, more detailed working procedures in the context of the day-to-day management of each function or task.

Maintenance and Update of the Project Management Plan

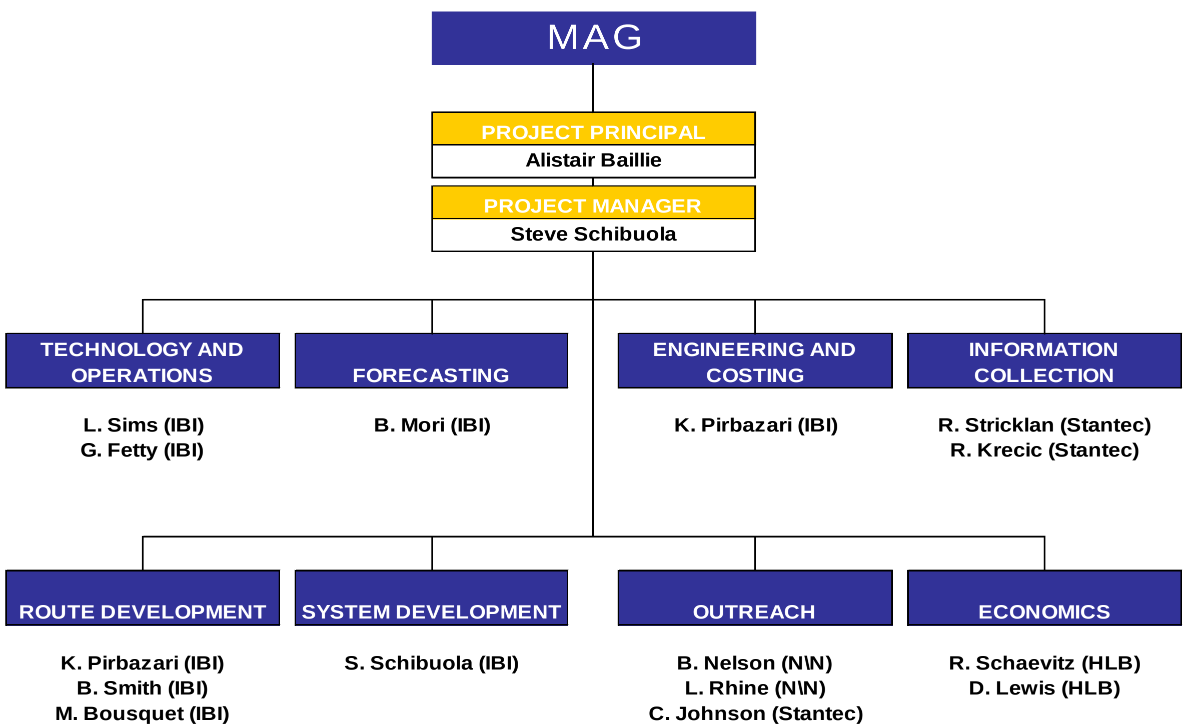
IBI Group will be the prime consultant for this project, providing leadership for the entire engagement with particular emphasis on its strengths in planning and consensus building and its experience in transportation planning, in particular with respect to high capacity modes. The skills of IBI Group will be complemented through specialized subconsultants with responsibilities in the following areas:

- **Stantec Inc.** – Engineering, GIS, Land Use, and Costing;
- **Nelson/Nygaard Consulting Associates** – Transit System Funding and Public/Agency Involvement;
- **HLB Decision Economics** – Finance, Economics, and Benefit Cost Analysis.

Organizational Chart

The organization of the IBI Group Team is illustrated in Exhibit 1.0-1.

Exhibit 1.0-1 **Project Organization Chart**



1.0.2 Project Schedule

The High Capacity Transit Plan study process is expected to be performed over the course of a 12 month timeframe. The Scope of Work for the project has been divided into six milestones. Table 1.0-1 shows the proposed project schedule.

- **Study Initiation:** This milestone will involve refining the project Scope of Work, preparation of a public involvement plan, review of past studies, and a comparison of high-capacity transit technologies.
- **Needs and Opportunities:** This milestone involves the identification of transit mode performance thresholds, development of modeling methods, and inventory of existing rail infrastructure.
- **Identification of Alternatives:** This milestone involves the determination of commuter rail feasibility, definition of the network of services, and identification of alternative high-capacity concepts.
- **Evaluation of Alternatives:** This milestone will identify costs, project ridership levels, and evaluate a range of transit alternatives, and potential corridors.
- **Regional Commuter Rail/High-Capacity Transit Plan:** This milestone will recommend a transit network, compare costs and ridership revenue, and prepare an implementation plan.

The sixth and final project milestone will be the release and adoption of the High Capacity Transit Plan Final Report.

Table 1.0-1 **MAG High Capacity Transit Plan Project Schedule**

		Milestone 1	2	3	4	5
		Study Initiation	Needs and Opportunities	Identification of Alternatives	Evaluation of Alternatives	Regional Commuter Rail/ High-Capacity Transit Plan
	Scope-of-Work Tasks	1,2,3	4,5,6	7,8,10	9,11,12	13,14,15
	Contents/Highlights	- Refined Work Scope - Public and Agency Involvement Plan - Past Studies - High-Capacity Transit Characteristics	- Mode Thresholds - Modeling Methods - Rail Inventory	- Commuter Rail Feasibility - Defined Network - Alternative High-Capacity Concepts	- Costs - Ridership - Evaluation of Alternatives	- Recommended Network - Costs, Ridership, Revenue - Implementation Plan
Consultation during Production	External Agencies*		February - March, 2002		August, 2002	
	Parallel Projects and Studies			May - June, 2002		November, 2002
	Elected Officials (Individual Metings)		February - March, 2002			November, 2002
	Public Consultation			May - July, 2002		November, 2002
	High-Capacity Working Group		February - March, 2002	May - July, 2002	August - September, 2002	October - December, 2002
Revision/ Approval	Draft to MAG	January 30, 2002	April 30, 2002	June 28, 2002	September 30, 2002	November 29, 2002
	MAG Comments to IBI	February 13, 2002	May 14, 2002	July 12, 2002	October 14, 2002	December 13, 2002
	Final to MAG	February 27, 2002	May 28, 2002	July 26, 2002	October 28, 2002	December 27, 2002
Presentation	High-Capacity Working Group	January 31, 2002	June, 2002	September, 2002	November, 2002	January, 2003
	Parallel Project Boards**			September, 2002		January, 2003
	MAG Transportation Review Committee			September, 2002		January, 2003
	MAG Management Committee			September, 2002		January, 2003
	MAG Council Transportation Subcommittee	January 23, 2002	June, 2002	September, 2002	November, 2002	January, 2003
	MAG Regional Council					January, 2003

*I.e. those not represented on the High-Capacity Working Group (e.g. railways), or individual meetings with HCWG members

**Valley Metro; Central Phoenix/East Valley LRT Project Agency Oversight Committee; RPTA Board of Directors

1.0.3 Public and Agency Involvement Plan

The draft PIP provides an overview of public involvement objectives for the MAG High Capacity Transit Plan, as well as specific actions that will be carried out by the consulting team in association with MAG staff.

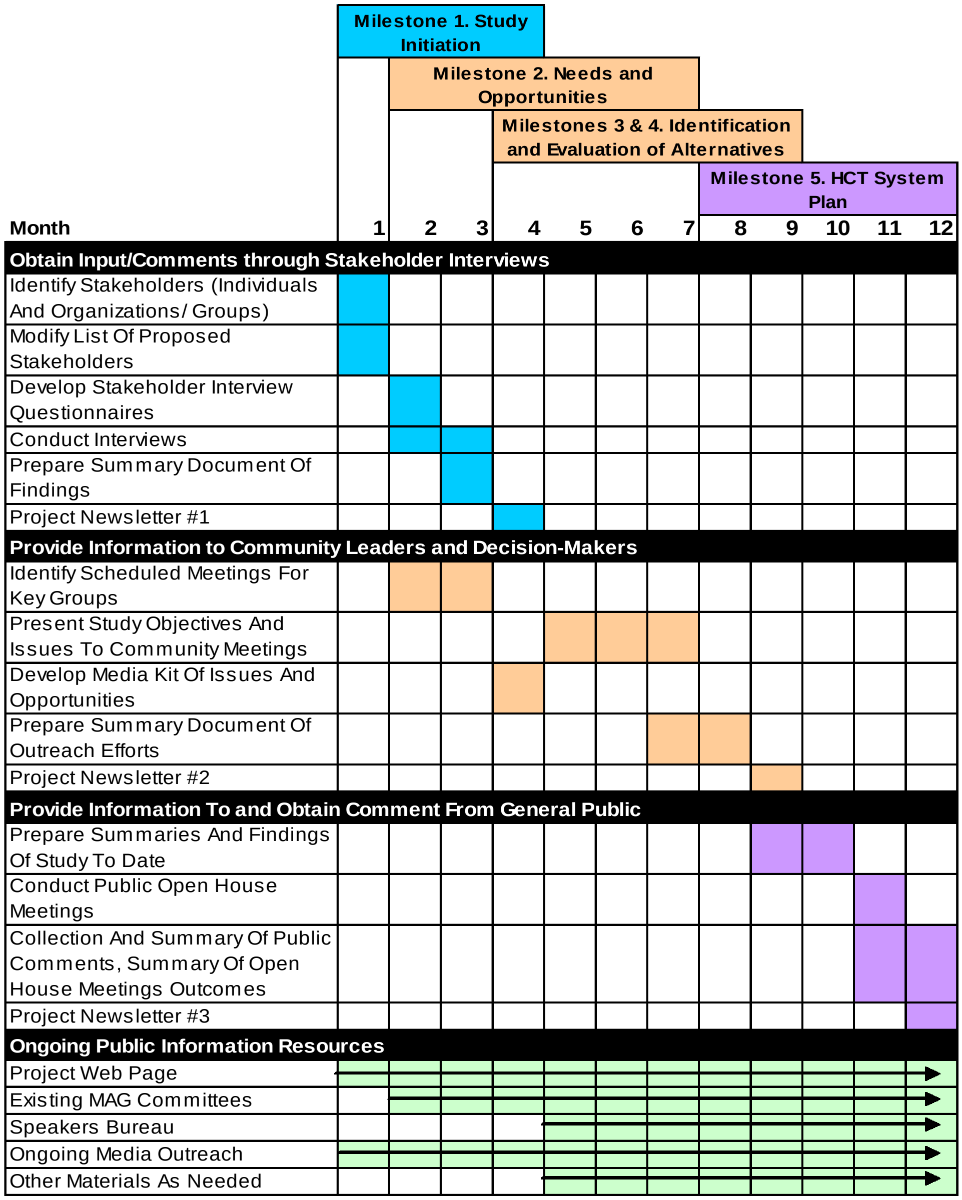
An effective and well-defined PIP allows MAG to provide outreach to citizens of the MAG region, political leaders, social service organizations, special interest groups and other agencies. These outreach efforts are designed to result in a greater understanding of the project and its objectives by members of these groups. The overall goal of the outreach effort is to create a document or plan which is endorsed by a coalition of groups representative of the residents of the MAG region.

The High Capacity Transit Plan PIP will take a three-tiered approach to optimize public participation in the planning process:

- **Listen to the community.** Gather useful information by talking with key players. The goal is to get all of the issues "on the table" early in the study process. This way, all concerns can be addressed at each stage of the High Capacity Transit Plan.
- **Integrate information.** Work with local organizations to share recommendations as the study progresses. Provide interagency coordination to ensure consensus is maintained throughout the study process.
- **Share information.** Provide informative, comprehensive information to the public. Showcase the public involvement process within the region.

Exhibit 1.0-2 illustrates a proposed implementation time line for the Public Involvement Plan.

Exhibit 1.0-2 **Public Involvement Plan Implementation Timeline**



1.0.4 Project Stakeholder Interviews

Ultimately, to better inform the public and solicit useful feedback as part of the planning process, it is necessary to obtain input from individuals within the community. To initiate the study, a series of stakeholder interviews will be conducted with political leaders, business organizations, transportation operators and community representatives.

Presentations will be made at community meetings throughout the MAG region. These meetings present a prime opportunity for soliciting information and comments for members of various community groups. Presentations will be made at meetings held throughout the study process to ensure the community is informed about the status of the project.

Five public open houses are scheduled during the development of the High Capacity Transit Plan. These open houses will be the focal point of efforts to obtain public input and comment about the study process and recommendations. Presentations and discussions at other public meetings in the MAG region are also part of this public outreach effort.

1.0.5 Public Outreach Support Elements

The public outreach process will be highlighted by the development and distribution of three project newsletters, the creation of a media kit for local news representatives, and the conducting of several public open houses to allow members of the general public an opportunity to learn about and comment on the project study.

The project newsletters will be released during the study process. Information contained within these newsletters would include the following:

Newsletter #1

- Objectives of the High Capacity Transit Study
- Summary of study process and outcomes
- Review comments of stakeholders
- Present next steps

Newsletter #2

- Update project progress
- List of organizations participating in study
- Preliminary study recommendations

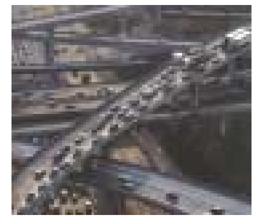
Newsletter #3

- Study findings
- Highlight role of public
- Project approval plan
- Next steps

Information and documents will be provided to MAG for posting on the MAG website or publications in MAG newsletters. These information outlets reach a large portion of the region's population and allow for a wide dissemination of information about the project.

1.0.6 Review of Transportation Studies

The High Capacity Transit Plan is being conducted concurrently with several other transportation studies and projects. Results from these other study efforts will be reviewed during the development of the High Capacity Transit Plan to identify ways that the High Capacity Transit Plan can be coordinated with the recommendations of the studies and proposed projects.



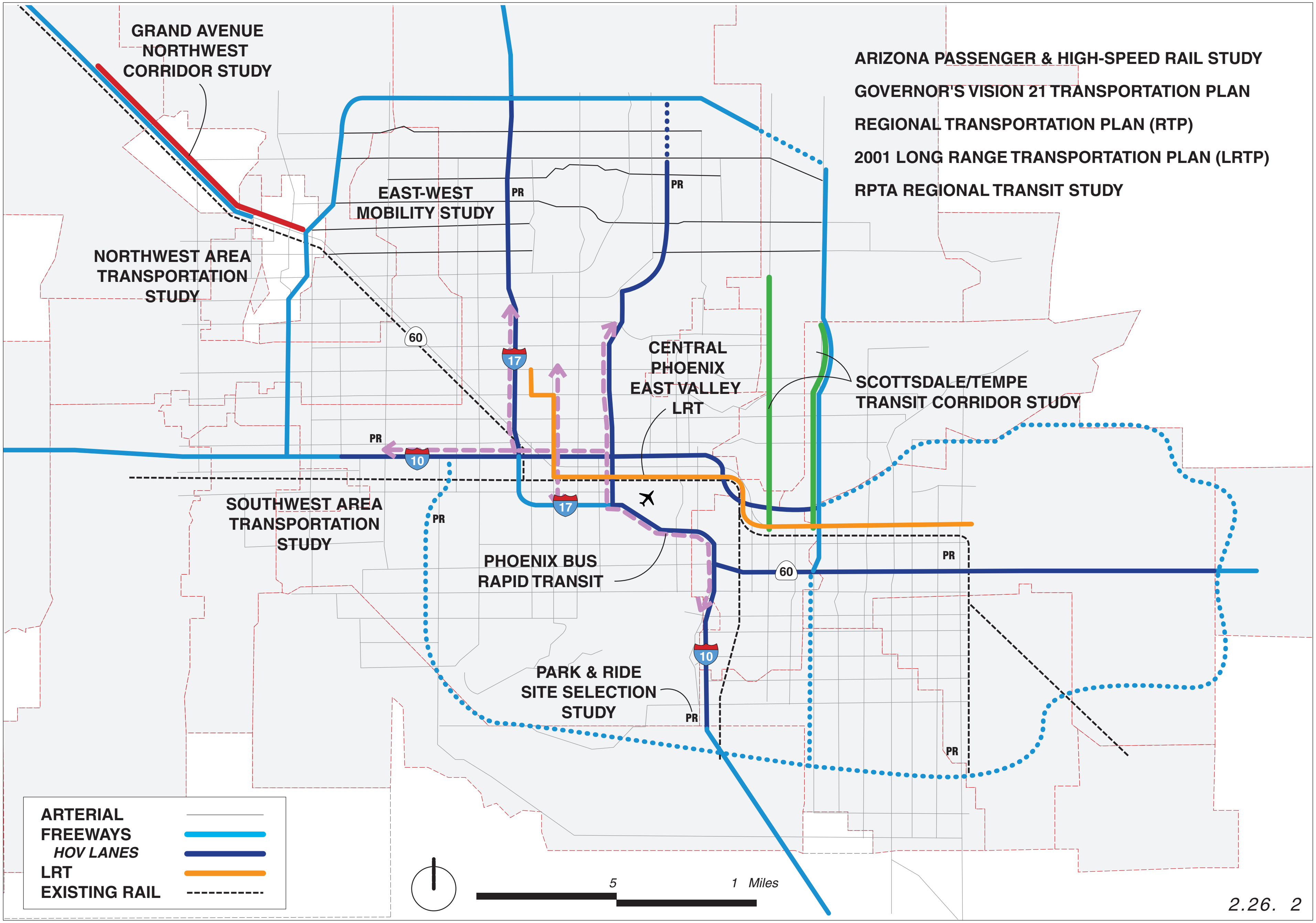
Current and recent regional transportation studies which will be studied during the development of recommendations for the MAG High Capacity Transit Plan include the City of Chandler High Capacity Transit MIS, the MAG Regional Transportation Plan, the Scottsdale/Tempe North/South Transit Corridor Study, the Governor's Vision 21 Transportation Plan, and the Park & Ride Site Selection Study. Statewide transportation studies will also need to be considered during the development of the MAG High Capacity Transit Plan, including several passenger rail studies conducted by the Arizona Department of Transportation (ADOT).

Table 1.0-2 summarizes the major ongoing transportation and transit studies in the MAG region. Exhibit 1.0-3 is a map of the MAG region showing the location of selected projects and studies.

Table 1.0-2 **Ongoing Transportation and Transit Studies**

Study Name	Lead Agency	Upcoming Project Milestones
Regional Transportation Plan	MAG	Analysis of Alternative Concepts: Summer 2002 Transportation Policies & Strategies: Fall 2002
Scottsdale/Tempe North/South Transit Study	City of Scottsdale City of Tempe	Tier 3 Review: Mid-2002
Transit Plan Update	City of Chandler	Financial Plan: March 2002 Final Report: April 2002
Chandler High Capacity MIS	City of Chandler	Tier 2 Report: April 2002 Tier 3 Report: July 2002 Implementation Program: August 2002

Study Name	Lead Agency	Upcoming Project Milestones
Regional Transit Study	Regional Public Transit Authority	Draft Alternatives & Recommendations: October 2002 Implementation Plan and Project Completion: December 2002
Grand Avenue Northwest Corridor	MAG	Final Report: March-April 2002
Northwest Area Transportation Study	MAG	Study Completion: Summer 2002
Southwest Area Transportation Study	MAG	Study Completion: Summer 2002
Southeast Area Transportation Study	MAG	Study Completion: End of 2002
East-West Mobility Study	MAG	Study Completion: Fall 2002



TRANSPORTATION STUDY FOR *MAG* MAP

IBI GROUP

Maricopa Association of Governments

1.0.7 High Capacity Transit Characteristics

A broad range of transit services and technologies exist in North America and throughout the world. Transit services can be classified into three broad categories:

- **Regional Connectors** – Transit services in this category provide high-speed, long-distance service within the metropolitan region, operating at scheduled speeds greater than 20 m.p.h. These services are designed to carry large numbers of passengers and serve a wide geographic area.
- **Primary Trunks** – Services in this category typically provide frequent service over medium to long distances at slightly lower speeds than regional connectors. These services are designed to carry a large number of passengers, in some cases more than regional connectors. However, the distance of traveled for many of these trips will be shorter in length than the average trip taken on a regional connector, with more stops and connection provdied to other transit services.
- **Local Feeders** – Transit services within this category provide connections between regional connectors, primary trunks, and transit centers to employment and residential destinations. Transit services identified in the earlier categories are usually unable to provide the local and sometimes door-to-door service provided by these local feeders.

Each service in these categories has a defined role to fulfill in a regional transit network. Service technologies recommended for implementation as a result of the development of the High Capacity Transit Plan will likely be classified as regional connectors or primary trunks.

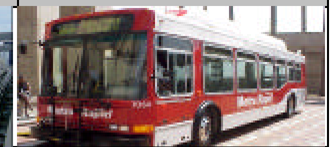
Five proven transit technologies will be evaluated for implementation in the transit corridors identified in the High Capacity Transit Plan. In addition to these proven technologies, several other existing and new technologies will also be studied. Other appropriate technologies including Diesel Multiple Unit (DMU) vehicles will be reviewed during the development of the study process.

Table 1.0-4 illustrates the classification of each transit technology in the three transit categories identified above. Table 1.0-5 presents a summary of high-capacity transit technologies.

Table 1.0-4 **Summary of Transit Service Roles**

Transit Technology	Regional Connector	Primary Trunk	Branch Service
Commuter Rail	☑		
Heavy Rail	☑	☑	
Light Rail	☑	☑	☑
Automated Guideway Transit		☑	☑
Bus Rapid Transit	☑	☑	☑

Table 1.0-5 **Summary of High-Capacity Transit Alternatives**

Attribute	Commuter Rail	Heavy Rail	Light Rail Transit	Automated Guideway Transit	Bus Rapid Transit
					
Peak Period Headway	10 to 60 minutes	2 to 10 minutes	5 to 10 minutes	2 to 10 minutes	2 to 10 minutes
Distance Between Stations	2 to 10 miles	0.25 to 2 miles	0.25 to 1 mile	0.25 to 1 mile	0.25 to 5 miles
Vehicle Type	Locomotive with single or bi-level cars or multiple unit cars	Single level cars	Single level LRT cars	Single level cars attached in pairs	40 to 60 foot single compartment or articulated buses
Capital Cost per Mile	$2 million to $25 million	$50 million to $100 million (elevated) $150 million to $250 million (subway)	$25 million to $50 million (at-grade) $50 million to $75 million (elevated)	$50 million to $100 million	$0.5 million to $6 million (Express bus) $0.5 million to $2 million (BRT Lite) $8 million to $14 million (BRT busway)
Average Passenger Capacity per Vehicle	100 to 200 passengers	200 passengers	50 to 150 passengers	50 to 100 passengers (regional service) 10 to 50 passengers (locational services)	40 to 100 passengers
Passenger Capacity per Hour	4,000 to 10,000 passengers	12,000 to 30,000 passengers	5,000 to 10,00 passengers	5,000 to 10,000 passengers (regional) 1,000 to 5,000 passengers (locational)	1,000 to 2,000 passengers (express bus) 3,000 to 7,000 passengers (BRT Lite, busway)
Power Source	Diesel locomotives or overhead eletric power	Electrified 3rd rail	Overhead electric wires	Electric	Diesel or LNG bus
Technology Advantages	Proven technology High speed service	Can transport high number of riders Frequent service	Most flexible rail technology Lower cost than heavy rail	No driver required Frequent service Can meet demand of passenger surges	Lowest capital cost Most flexible to expand and change alignments
System Limitations	Can only operate in rail corridors All day operations costly	Must be grade separated Needs large passenger base to be cost-effective	May require arterial street widening	Must be grade separated	May require arterial street widening

1.0.8 Transit Amenities

The Federal Transit Administration (FTA) has researched the impacts of improved rider amenities upon transit ridership. A report produced by the Transportation Research Board (TRB) for the FTA in 1999 examined the influence of user amenities on ridership and ways for local transit providers to select the correct amenities to meet the needs of their ridership base. Improved amenities were found to create a more positive view of transit services and attract new transit riders. However, the functionality of amenities was as important as the presence of the amenities. Poorly designed or unneeded amenities were seen more as a waste of money than as system improvements. The type of amenities most likely to attract riders varies depending upon the type of rider utilizing the service, the length of wait for vehicles, average passenger trip length, and the environmental characteristics of the region.

Commuter rail stations can have the most amenities as a result of the longer station wait times. Heavy rail, LRT, AGT, and BRT stations usually do not provide the same level of amenities present at commuter rail stations. These forms of high capacity transit systems provide more frequent service, with two to 15 minute headways, making station wait times for riders usually no longer than 15 minutes. The shorter wait times for riders at these stations reduce the need for additional amenities. Most riders would not be able to utilize and enjoy the same amenities offered at commuter rail station without missing their train.

The amenities and features found on high capacity transit vehicles can improve the perception potential riders have about the quality of service provided. Similar to the patterns for station amenities, vehicle amenities can vary depending upon the average trip length for riders and the type of riders using the service.

Long distance trips necessitate a certain set of amenities which should be provided for riders. Most commuter rail vehicles offer upholstered seats with high backs, restrooms, and large windows for passengers to view the passing scenery. Riders may also be attracted by the presence of power outlets for laptop computers and desk workspaces. These amenities can allow riders to be more productive with their commute time.

On board amenities for other high capacity transit vehicles providing shorter distance trips are equally important. Interior improvements include better lighting, larger windows, and upholstered seats. Innovative exterior designs are also helpful in attracting riders. Both vintage and futuristic designs can attract riders to try the transit system. Vintage vehicles present an opportunity to connect with the past and make riders feel nostalgic. Futuristic designs imply speed and fast service, attracting riders who want to travel and reach their destinations quickly and on time.

The results of this research will be considered in the development of alternatives in the next study phase.

1.1 Scope of Work and Project Management Plan

1.1.1 Introduction

This document describes the Project Management Plan (PMP) that will guide the work of the Consultant Project Team for the Maricopa Association of Governments High Capacity Transit Plan. There are three purposes to the PMP for the Consultant Team:

- Establish the framework for completing the technical analysis of the project over a 12-month timeframe.
- Specify the project's management procedures and organizational structure.
- Provide guidelines for the orderly interaction and participation of the different team members.

The PMP is organized as follows:

- General Information
- Organization and Staffing
- Scope of Services and Schedule
- Document and Information Control

1.1.2 General Information

Purpose of the Project Management Plan

The purpose of this Project Management Plan is to communicate the objectives of the MAG High Capacity Transit Study to all of the Consultant Team participants. It presents the overall management strategy and the responsibilities, authorities, and procedures guiding the various portions of the project.

The Project Management Plan is a framework. It provides a structured approach to completing the defined tasks of the project. Managers and staff implementing the Plan will provide additional, more detailed working procedures in the context of the day-to-day management of each function or task.

This Project Management Plan emphasizes a team approach. A coordinated effort to meet the objectives is essential in completing the project in a timely and efficient manner. Each participant must know their role, and the role of the other participants. The participant must also understand the roles of primary responsibility and secondary or assistant capacity.

Maintenance and Update of the Project Management Plan

The development of the Project Management Plan will be an evolutionary process. The Plan will be updated and revised as needed. It is intended to provide the context, guidelines, practices, procedures, and to some extent, the philosophy for management of the Project. The maintenance of and subsequent revisions to the Plan are the responsibility of the Project Director, or by delegation to the Consultant Project Manager.

Project Background and Planning

Commuter rail service has a number of features that may allow it to play an important role in providing an additional transportation option that complements other transit and roadway modes. A study is needed to evaluate the possible use of existing railroad corridors for commuter rail, estimate the costs and benefits of these services, and assess how it would interact with other modes. In some corridors, the operation of conventional commuter rail may encounter significant obstacles. Other high capacity transit technologies, such as bus rapid transit, elevated rail (including monorail), or subways, may be more appropriate in these corridors. There may still be other areas of the MAG region without railroad right-of-way where new high capacity transit may be warranted. To pursue these opportunities for commuter rail and high capacity transit in the region, a project is being initiated in the MAG FY 2002 Unified Planning Work Program to conduct a Regional High Capacity Transit Study.

MAG is currently developing a Regional Transportation Plan (RTP) that will replace the existing Long Range Transportation Plan. The RTP will provide a policy framework to guide transportation investments over the next twenty years. As a part of the RTP, performance measures will be developed to provide a balanced multi-modal transportation system that meets regional goals and objectives. The planning efforts for the High Capacity Transit Plan developed in this work scope will be integrated with the development of the RTP.

The objectives of this study are to:

- Conduct a feasibility analysis of commuter rail along existing rail corridors.
- Identify alternative high capacity transit service concepts for existing rail corridors where commuter rail is not feasible, such as light rail, express bus service, bus rapid transit or elevated rail.

- Identify new alternative high capacity transit services corridors.
- Using the results of 1 through 3, above, create a regional high capacity transit system plan.
- Develop an action/implementation plan to identify roles and responsibilities.

1.1.3 Organization and Staffing

Overview

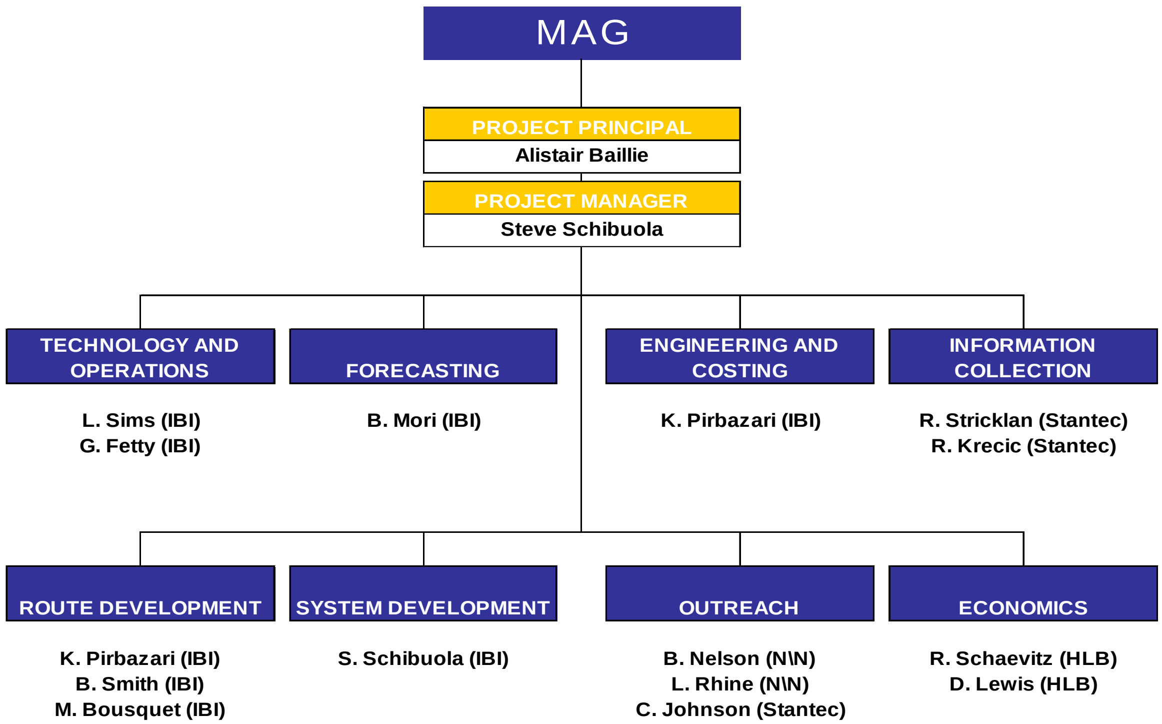
IBI Group will be the prime consultant for this project, providing leadership for the entire engagement with particular emphasis on its strengths in planning and consensus building and its experience in transportation planning, in particular with respect to high capacity modes. The skills of IBI Group will be complemented through specialized subconsultants with responsibilities in the following areas:

- **Stantec Inc.** – Engineering, GIS, Land Use, and Costing;
- **Nelson/Nygaard Consulting Associates** – Transit System Funding and Public/Agency Involvement;
- **HLB Decision Economics** – Finance, Economics and Benefit Cost Analysis.

Organizational Chart

The organization of the IBI Group Team is illustrated in Exhibit 1.1-1.

Exhibit 1.1-1 **Project Organizational Chart**



Management Approach

The basic management approach to the MAG High Capacity Transit Plan will use past studies, current projects, and public involvement as a base on which to build.

Listed below are the management principles for the MAG High-Capacity Transit Plan:

- MAG will provide overall policy direction for the project.
- The Consultant Team under the leadership of the Project Manager will perform all technical analyses.
- Day-to-day decision-making authority and single-point contact will reside with the MAG Project Manager or designate.
- The Consultant Team will perform their services according to the Scope of Work.
- The Consultant Team will be responsible for developing and maintaining all scheduling, cost estimating, budgeting, cost tracking, reporting and forecasting systems.
- Work progress, schedule and budget status will be reported on a monthly basis.

All consultants and contractors will be required to follow applicable correspondence control procedures. All correspondence relating to the project will be assigned file codes and placed in the filing system: submittals, transmittals, memos, invoices, etc.

Key Client Contacts

Table 1.1-1 shows the key client contacts for the High Capacity Transit Plan.

Table 1.1-1 **Summary of Key Client Contacts**

Name	Organization/Address	Phone	FAX	E-Mail
Dawn Coomer	MAG 302 North 1st Avenue, Suite 300 Phoenix, AZ 85003	602-254-6300	602-254-6490	dcoomer@mag.maricopa.gov
Eric Anderson	MAG 302 North 1st Avenue, Suite 300 Phoenix, AZ 85003	602-452-5008	602-254-6490	eanderson@mag.maricopa.gov
Mark Schlappi	MAG 302 North 1st Avenue, Suite 300 Phoenix, AZ 85003	602-452-5921	602-254-6490	mschlappi@mag.maricopa.gov

Name	Organization/Address	Phone	FAX	E-Mail
Don Worley	MAG 302 North 1st Avenue, Suite 300 Phoenix, AZ 85003	602-254-6300	602-254-6490	dworley@mag.maricopa.gov
Roger Herzog	MAG 302 North 1st Avenue, Suite 300 Phoenix, AZ 85003	602-254-6300	602-254-6490	rherzog@mag.maricopa.gov
Auubhav Bagley	MAG 302 North 1st Avenue, Suite 300 Phoenix, AZ 85003	602-254-6300	602-254-6490	abagley@mag.maricopa.gov

Consultant Contacts

Table 1.1-2 shows the key consultant contacts for the High Capacity Transit Plan.

Table 1.1-2

Summary of Key Consultant Contacts

Name	Organization/Address	Phone	Cell Phone	FAX	E-Mail
Baillie, Alistair	IBI Group Suite 110 18401 Von Karman Ave. Irvine, CA 92612	949-833-5588	949-500-0637	949-833-5511	abaillie@ibigroup.com
Schibuola, Steve	IBI Group Suite 110 18401 Von Karman Ave. Irvine, CA 92612	949-833-5588	949-500-2310	949-833-5511	sschibuola@ibigroup.com
Pirbazari, Keyvan	IBI Group Suite 110 18401 Von Karman Ave. Irvine, CA 92612	949-833-5588	949-466-6659	949-833-5511	kpirbazari@ibigroup.com
Lee Sims	IBI Group Suite 110 18401 Von Karman Ave. Irvine, CA 92612	949-833-5588		949-833-5511	lsims@ibigroup.com
Bruce Mori	IBI Group Suite 110	949-833-5588		949-833-5511	bmori@ibigroup.com

Name	Organization/Address	Phone	Cell Phone	FAX	E-Mail
	18401 Von Karman Ave. Irvine, CA 92612				
Marsha Bousquet	IBI Group Suite 110 18401 Von Karman Ave. Irvine, CA 92612	949-833-5588	949-466-5810	949-833-5511	mbousquet@ibigroup.com
Blair Smith	IBI Group Suite 110 18401 Von Karman Ave. Irvine, CA 92612	949-833-5588		949-833-5511	blairsmith@ibigroup.com
Ryan Gulick	IBI Group 4395 S. Price Road Tempe, AZ 85282	602-821-4219	480-755-1049		rgulick@ibigroup.com
George Fetty	IBI Group 277 Pomona Avenue Long Beach, CA 90803	562-434-6428	562-243-7257	562-439-3509	gfetty@aol.com
Carol Johnson	Stantec Consulting, Inc. 8211 South 48th Street Phoenix, AZ 85044	602-438-2200		602-431-9562	cajohnson@stantec.com
Rudy Stricklan	Stantec Consulting, Inc. 8211 South 48th Street Phoenix, AZ 85044	602-438-2200		602-431-9562	rstricklan@stantec.com
Rich Krecic	Stantec Consulting, Inc. 8211 South 48th Street Phoenix, AZ 85044	602-438-2200		602-431-9562	rkreci@stantec.com
Bonnie Nelson	Nelson/Nygaard Associates 833 Market Street, Suite 900 San Francisco, CA 94103	415-284-1544		415-284-1554	bnelson@nelsonnygaard.com
Linda Rhine	Nelson/Nygaard Associates 833 Market Street, Suite 900 San Francisco, CA 94103	415-284-1544		415-284-1554	lrhine@nelsonnygaard.com

Name	Organization/Address	Phone	Cell Phone	FAX	E-Mail
Jarrett Walker	Nelson/Nygaard Associates 833 Market Street, Suite 900 San Francisco, CA 94103	415-284-1544		415-284-1554	jwalker@nelsonnygaard.com
Joey Goldman	Nelson/Nygaard Associates 833 Market Street, Suite 900 San Francisco, CA 94103	415-284-1544		415-284-1554	jgoldman@nelsonnygaard.com
Robert Schaevitz	HLB Decision Economics, Inc. 2233 Watt Avenue, Suite 300 Sacramento, CA 95825	916-486-8042	916-709-0459	916-486-8043	robert_schaevitz@hlb-econ.com
David Lewis	HLB Decision Economics, Inc. 2233 Watt Avenue, Suite 300 Sacramento, CA 95825	916-486-8042		916-486-8043	david_lewis@hlb-econ.com
Khalid Bekka	HLB Decision Economics, Inc. 2233 Watt Avenue, Suite 300 Sacramento, CA 95825	916-486-8042		916-486-8043	khalid_bekka@hlb-econ.com
Stephanie Gros	HLB Decision Economics, Inc. 2233 Watt Avenue, Suite 300 Sacramento, CA 95825	916-486-8042		916-486-8043	stephanie_gros@hlb-econ.com

1.1.4 Scope of Services and Schedule

The Scope of Work for the MAG High Capacity Transit Plan (See Appendix) has been divided into six milestones:

- **Study Initiation:** This milestone will involve refining the project Scope of Work, preparation of a public involvement plan, review of past studies, and a comparison of high-capacity transit technologies.

- **Needs and Opportunities:** This milestone involves the identification of transit mode performance thresholds, development of modeling methods, and inventory of existing rail infrastructure.
- **Identification of Alternatives:** This milestone involves the determination of commuter rail feasibility, definition of the network of services, and identification of alternative high-capacity concepts.
- **Evaluation of Alternatives:** This milestone will identify costs, project ridership levels, and evaluate a range of transit alternatives, and potential corridors.
- **Regional Commuter Rail/High-Capacity Transit Plan:** This milestone will recommend a transit network, compare costs and ridership revenue, and prepare an implementation plan.

A sixth and final project milestone will be the release and adoption of the High Capacity Transit Plan Final Report.

The process for meeting each of these milestones is outlined in Table 1.1-3. This includes the highlights of each task, and the steps needed during production, revision, and approval processes to complete the milestone. Completion dates are also provided for each milestone. Other than the dates when draft milestone documents will be delivered to MAG, the dates are tentative and will be updated periodically.

Table 1.1-3 **MAG High Capacity Transit Plan Project Schedule**

		Milestone 1	2	3	4	5
		Study Initiation	Needs and Opportunities	Identification of Alternatives	Evaluation of Alternatives	Regional Commuter Rail/ High-Capacity Transit Plan
	Scope-of-Work Tasks	1,2,3	4,5,6	7,8,10	9,11,12	13,14,15
	Contents/Highlights	- Refined Work Scope - Public and Agency Involvement Plan - Past Studies - High-Capacity Transit Characteristics	- Mode Thresholds - Modeling Methods - Rail Inventory	- Commuter Rail Feasibility - Defined Network - Alternative High-Capacity Concepts	- Costs - Ridership - Evaluation of Alternatives	- Recommended Network - Costs, Ridership, Revenue - Implementation Plan
Consultation during Production	External Agencies*		February - March, 2002		August, 2002	
	Parallel Projects and Studies			May - June, 2002		November, 2002
	Elected Officials (Individual Metings)		February - March, 2002			November, 2002
	Public Consultation			May - July, 2002		November, 2002
	High-Capacity Working Group		February - March, 2002	May - July, 2002	August - September, 2002	October - December, 2002
Revision/ Approval	Draft to MAG	January 30, 2002	April 30, 2002	June 28, 2002	September 30, 2002	November 29, 2002
	MAG Comments to IBI	February 13, 2002	May 14, 2002	July 12, 2002	October 14, 2002	December 13, 2002
	Final to MAG	February 27, 2002	May 28, 2002	July 26, 2002	October 28, 2002	December 27, 2002
Presentation	High-Capacity Working Group	January 31, 2002	June, 2002	September, 2002	November, 2002	January, 2003
	Parallel Project Boards**			September, 2002		January, 2003
	MAG Transportation Review Committee			September, 2002		January, 2003
	MAG Management Committee			September, 2002		January, 2003
	MAG Council Transportation Subcommittee	January 23, 2002	June, 2002	September, 2002	November, 2002	January, 2003
	MAG Regional Council					January, 2003

*I.e. those not represented on the High-Capacity Working Group (e.g. railways), or individual meetings with HCWG members

**Valley Metro; Central Phoenix/East Valley LRT Project Agency Oversight Committee; RPTA Board of Directors

1.1.5 Document and Information Control

Data Control

The Project Manager will review all data provided by MAG, outside agencies and/or obtained by team members before use. Substantial data already exists from related studies and this will be catalogued at project start-up, using standard data filing/naming convention so that its availability is known to other IBI Group Team members.

External Communications Plan

In the course of their work, many members of the project team will come into contact with agency representatives or the public, who will request information. The following procedures will be used in such situations.

- Requests for basic technical facts or information, if within your area of technical expertise, respond directly. Send a brief e-mail to your task leader summarizing the exchange.
- Requests for reports, large amounts of data, etc. refer to Project Manager. For products deemed final by MAG, the Project Manager will disseminate. For a draft or working product, the Program Manager will confer with MAG.
- Requests for non-technical information – policy, financing, etc.), refer to the Project Manager, who will confer with MAG's Project Manager.
- Requests from the News Media; refer to the Project Manager, who will confer with the MAG's Project Manager.
- Requests from Elected Officials; refer to the Project Manager, who will confer with MAG's Project Manager.

Project Correspondence

The Project Manager will be the point of contact for MAG, sub-consultants and external agencies for all reports and correspondence. Incoming documents will be date-stamped and reviewed by the Project Manager with appropriate action taken. Copies will then be distributed to all concerned team members, and the central file. Outgoing documents will originate with team members responsible for a given task. The Project Manager will review the document to ensure that the contents are precise, grammatically correct and addressed/distributed to the appropriate individuals. Milestone documents will be dated and identified as Draft, Preliminary, Final, and Approved, as appropriate with a list of persons on the circulation list. This will allow easy identification of document status and currency. Other provisions will be developed with MAG for the format, distribution and review of reports.

APPENDIX A

APPENDIX A
SCOPE OF SERVICES
MARICOPA ASSOCIATION OF GOVERNMENTS (MAG)
HIGH CAPACITY TRANSIT PLAN

PROJECT UNDERSTANDING

Commuter rail service has a number of features that may allow it to play an important role in providing an additional transportation option that complements other transit and roadway modes. A study is needed to evaluate the possible use of existing railroad corridors for commuter rail, estimate the costs and benefits of this service, and assess how it would interact with other modes. In some corridors, the operation of conventional commuter rail may encounter significant obstacles. Other high capacity transit technologies, such as bus rapid transit, elevated rail (including monorail), or subways, may be more appropriate in these corridors. There may still be other areas of the MAG region without railroad rights-of-way where new high capacity transit may be warranted. To pursue these opportunities for commuter rail and high capacity transit in the region, a project is being initiated in the MAG FY 2002 Unified Planning Work Program to conduct a Regional High Capacity Transit Study.

MAG is currently developing a Regional Transportation Plan (RTP) that will replace the existing Long Range Transportation Plan. The RTP will provide a policy framework to guide transportation investments over the next twenty years. As a part of the RTP, performance measures will be developed to provide a balanced multi-modal transportation system that meets regional goals and objectives. The planning efforts for the High Capacity Transit Plan developed in this work scope will be integrated with the development of the RTP.

The objectives of this study are to:

1. Conduct a feasibility analysis of commuter rail along existing rail corridors.

2. Identify alternative high capacity transit service concepts for existing rail corridors where commuter rail is not feasible, such as light rail, express bus service, bus rapid transit or elevated rail.

3. Identify new alternative high capacity transit service corridors.

4. Using the results of 1 through 3, above, create a regional high capacity transit system plan.

5. Develop an action/implementation plan to identify roles and responsibilities.

I. TASKS TO BE PERFORMED FOR THE STUDY

The purpose of this section is to outline the major tasks required to be performed by the CONSULTANT in order to produce the needed analyses and deliverables to MAG.

PART I: GENERAL TASKS

Task 1: Refine the Work Scope

Additional refinements in the scope of work may be necessary during the contract period. The CONSULTANT may refine the scope of work, based upon professional experience, new information, or test results. Revisions to the Scope of Work will be determined jointly by the CONSULTANT and the MAG project manager. A detailed project schedule, including level of coordination with other transit planning efforts, shall be outlined in the revised scope of work. In the event that a revision is needed, the CONSULTANT will furnish the MAG project manager with one copy of an initial revised Scope of Work and Project Schedule, including a revised labor/dollar allocation and project task cost breakdown, for internal review. The CONSULTANT will incorporate any comments from MAG into a final revision and supply one copy to MAG.

Task 2: Develop Public and Agency Involvement Plan

The CONSULTANT will develop a plan for public and agency involvement with assistance from the MAG Project Manager. The MAG Transportation Review Committee will provide oversight for the development of the Plan with the assistance of an Agency Oversight Team (AOT). The AOT will be comprised of project partners including representation from MAG member agencies, ADOT, RPTA, staff members from the Central Phoenix/East Valley Rail Project and railroad owners and operators. The public involvement plan (PIP) should identify key milestones for consultation, approximate timing and methods for generating input. Innovative and effective efforts to maximize resources in holding meetings are encouraged, such as joint meetings, attending meetings of interested groups at pre-established times and places, integrating with the existing MAG, RPTA and ADOT public involvement process, etc. The PIP shall strive to involve affected and interested persons and agencies early in and throughout the process, and define ways to involve persons directly affected by potential alternative alignments. The PIP shall involve agencies responsible for implementing the final Plan, especially railroad and transit owners and operators. The PIP shall include dialogue with the Union Pacific and Burlington Northern Railroad companies, and other railroad interests, such as Amtrak, to document the concerns of using existing railroad rights-of-way for commuter rail. The PIP shall be linked with the public and agency involvement process underway in the development of the MAG Regional Transportation Plan.

Stakeholders will be identified with the assistance of the MAG Project Manager, the MAG Transportation Review Committee, and the AOT. The developed list(s) of stakeholders will include names, addresses, phone numbers, fax numbers and e-mail addresses. The CONSULTANT will consult with staff from MAG, ADOT, and RPTA, staff of MAG member agencies, including intergovernmental liaisons, and staff from the Central Phoenix/East Valley Light Rail Transit Project to identify other potential stakeholders to be consulted in developing the plan, and to provide general comments on the draft PIP. The CONSULTANT shall provide resources to maintain the stakeholder list and to fully implement the developed PIP.

Task 3: Review Prior Studies and Conduct Review of High Capacity Transit Characteristics

The CONSULTANT shall review prior studies and regional, state and federal policies regarding high capacity transit. The CONSULTANT will conduct a review of the characteristics of commuter rail and other high capacity transit modes in other urban areas, including equipment, facilities and operations. The review shall include information on vehicles, capacity, speeds, frequencies, hours of operation, fares, and support facilities (including park and ride lots, supporting bus service, and maintenance and storage facilities). Commuter rail shall be compared and contrasted with other high capacity transit modes, such as light rail, express bus, bus rapid transit, and elevated rail. The review will assemble technical, cost and other data on technologies that might be considered and highlight key factors, relationships, synergies and conflicts that accompany different technology and right-of-way choices and their ability to respond to transportation, development and environmental objectives. The review shall also consider how improved user amenities, such as fiber optic connections in vehicles and more spacious seating, improve the attractiveness of high capacity transit modes.

Task 4: Identify and Refine Thresholds for Commuter Rail and Other High Capacity Transit Operation

The CONSULTANT shall determine characteristics conducive to commuter rail and other high capacity transit options. These characteristics shall include typical trip patterns, travel time, employment and residential densities, commute distance and station spacing. Thresholds will be used to develop a baseline to assess commuter rail and/or other high capacity transit options.

Results of Task 3 will provide general information on the capacities and other characteristics of various high capacity modes. In this task, thresholds will be developed based on an examination of existing high capacity systems and the factors contributing to successful service, including improved user amenities and technological advances. The information to be compiled for commuter rail/high capacity systems in other cities will include system descriptions (system and service area definition, population, level-of-services, etc.), ridership, cost and performance data. The information will be summarized to allow comparisons between the systems, leading to the establishment of factors needed to achieve a successful system. The thresholds will be set and the alternatives that fall beneath these thresholds will be eliminated from further detailed analysis.

The CONSULTANT will compare the identified thresholds with current and projected travel characteristics in the MAG region to compare regional travel characteristics with successful commuter rail and high capacity transit systems in other urban areas. Opportunities and constraints will be identified and analyzed. The application of patronage thresholds will require preliminary estimates of ridership, but at a broad level of detail. Demand forecasts from the MAG transportation model will be used to develop corridor profiles to describe the competitive context of transit in each corridor in relation to other transportation infrastructure and services in the corridor: origin-destination patterns, key market segments and travel characteristics; and transportation needs in each corridor and prospects for improved transit. The analysis will define the gap between transportation problems and existing supply, unmet transit needs and other strategic considerations, which will greater assist in the determination of demand thresholds. It will provide a basis for justifying enhanced transit in the MAG region and for selecting the corridors to be included in the various commuter rail and high capacity transit networks in Tasks 7 and 11.

After this analysis, the CONSULTANT will refine the threshold criteria to develop criteria to assess commuter rail and other high capacity transit alternatives. Stakeholders shall be included in the process for developing and refining criteria. Potential criteria could include: impacts on the fixed route and planned light rail transit systems, integration with other transportation system elements, land use impacts and compatibility with land use objectives, accessibility, transit system efficiency, ridership, impacts to roadway mobility and congestion, willingness of rail owner/operator to allow commuter rail, revenue and financing issues, and impacts on Title VI communities. The distribution of population by income groups and auto ownership levels will be examined to determine whether there are ay potential environmental justice issues. The criteria will include the development of performance measures and other factors for evaluation of alternatives.

As part of the constraints analysis, the CONSULTANT shall examine how public acquisition of rail right-of-way could address operations issues and liability constraints. Public purchase options should also examine how freight operations could be accommodated, such as leaseback of freight operating rights, contracting with a short line freight operator for interchange service, etc. Public acquisition of right-of-way could address several issues including tort liability, operational control, and public reluctance to finance capital improvements on private property. Models of governance for successful commuter rail systems shall also be identified.

As a part of this Task, the CONSULTANT shall review existing land use plans of MAG member agencies to assess whether current and project land use patterns are conducive to high capacity transit.

Task 5: Develop Travel Demand Modeling Methods and Identify Socioeconomic Forecast Scenarios

The CONSULTANT will develop commuter rail and other high capacity transit travel demand modeling methods. This model shall be used to project short and long term ridership of commuter rail. The CONSULTANT shall allow for the analysis of the potential population served by commuter rail and other high capacity transit services to assure that Title VI and environmental justice concerns are addressed. Travel demand modeling shall consider the effect of inter-modal transfers on project ridership, such as bus to train, car to train, walk to train, train to bus or light rail, etc.

To provide a technical basis for analyzing transportation and air quality plans, MAG maintains a comprehensive set of models to systematically project employment and population, traffic demand, and air quality. These models allow both the projection of current trends and the evaluation of planning alternatives. MAG transportation model assignments will be available to the CONSULTANT. As part of this task, the CONSULTANT shall review regional socioeconomic data bases, identify forecast scenarios and prepare data for use in the study process. MAG socioeconomic and land use data will also be available. This data is available by Traffic Analysis Zone (TAZ) for 2000, 2010, 2020, 2025 and 2040. The MAG travel demand models forecast roadway and transit use throughout the metropolitan area. Key outputs of these models include projections of average daily traffic, peak hour traffic trips by purpose and mode, traffic volume to roadway capacity ratios, level of service at intersections, delay and travel time. GIS information on existing land use and land use plans is also available. The primary output of the MAG socioeconomic models is projections of population, households, land use and employment by small area.

PART II: COMMUTER RAIL ANALYSIS

Task 6: Inventory Facility and Operational Characteristics and Issues of Existing Rail Corridors in the Region

Existing rail facilities in the MAG region shall be identified, along with their operational characteristics. Existing right-of-way widths shall be examined since this factor could affect the potential for double tracking within existing right-of-way. The inventory shall include identification of needed track condition and its acceptability for commuter rail service, as well as stations and an assessment of the condition of existing stations. The inventory shall include the need for system refreshments (steel and tie replacements, signal and grade crossing improvements) and capacity improvements (passing sidings) that will be needed to safely and efficiently move passenger trains within a freight railroad environment. The inventory shall also include current and projected levels of freight service in existing corridors, the number of trains and freight cars per day by mile segments of track, and locations of rail yards, piggyback operations and rail spurs. Potential issues relating to shared use of rail corridors between commuter service and freight and intercity passenger rail service shall be identified.

With the assistance of key stakeholders, issues associated with the provision of commuter rail services in rail corridors where current freight activity is high or is projected to increase that may impact the feasibility of commuter rail shall be identified. The issue of shared use between commuter rail and freight and intercity passenger service, impacts of additional traffic on operations, maintenance and capital costs for rail owners, the negotiation of access rights, and the potential purchase of the track by a public entity in the MAG region will be explored. Grade safety crossing issues, noise impact issues and other neighborhood or adjacent property impacts shall be addressed. With the assistance of key stakeholders, potential solutions to these issues will be identified. Traffic impacts and delays associated with commuter rail service should also be identified.

Task 7: Assess Feasibility of Commuter Rail Service in Existing Corridors and Identify Feasible Commuter Rail Corridors

The feasibility of commuter rail in existing rail corridors will be established using the threshold criteria, the generalized corridor flows and a review of the operational characteristics in each of the existing corridors (developed in Task 4) and the socioeconomic scenarios developed in Task 5. Commuter rail alternatives shall be developed at a level of detail sufficient to estimate ridership, capital costs, operational costs, and provide information for alternatives evaluation. Costs shall include support facilities and maintenance and storage facilities. Transfer centers, hours of operation and train frequency shall also be considered. The objective of this task is to identify existing rail corridors that are feasible for commuter rail, and existing rail corridors that are not feasible for commuter rail. Commuter rail shall be compared with other feasible high capacity transit options. Pedestrian and motorist safety shall be addressed, including consideration of the safety and operations of commuter rail across rail/highway crossings. Potential impacts on land use, economic development and adjacent neighborhoods shall be identified. Options to make commuter rail more feasible should also be explored. For example, relocating yards and piggyback operations measures to shift freight operations to possibly free-up rail capacity for commuter service should be explored.

As a part of this Task, the CONSULTANT shall consider existing land use plans of MAG member agencies to assess whether current and project land use patterns are conducive to high capacity transit. Potential changes to local plans that would enhance high capacity transit should be identified and addressed as part of the feasibility analysis. The CONSULTANT shall also analyze the potential population served by commuter rail to assure that Title VI and environmental justice concerns are addressed.

<u>Task 8: Define Regional Commuter Rail Network and Preliminary Operating Characteristics</u>

Based on the results of prior tasks, the CONSULTANT shall identify a regional commuter rail network and preliminary operating characteristics of the commuter rail. The stakeholders and agencies identified in Task 2 shall have input on the operating characteristics of the commuter rail system. In order to achieve system continuity of the proposed system, short sections of new commuter rail corridor may be identified in this Task. Potential termini of the system shall be identified, along with rights-of-way and the costs identified in Task 7. General locations for maintenance and storage facilities, additional park and ride lots, and transfer stations between commuter rail and other modes shall be identified. General operating characteristics, such as hours and frequency of service, will be identified. Successful approaches to governance for the commuter rail system in other areas shall be identified.

<u>Task 9: Estimate Commuter Rail System Ridership and Potential Revenues; Estimate Operating and Capital Costs</u>

Based on the operating characteristics identified in Task 8, commuter rail ridership and potential revenues will be identified.

Operating and capital costs of having commuter rail on feasible corridors will be determined. The estimate of operations costs shall include the provision of commuter rail, additions to the planned bus system to support commuter rail, support facilities, and maintenance of facilities and vehicles. Other factors that could affect operations costs may include fees for access rights and indemnification, and maintenance plans. Capital costs will depend on factors such as hours of operation, train frequency, and the need for additional park and ride lots. As part of capital costs, track rehabilitation, ancillary improvements costs, associated equipment, cost of upgrading existing transfer sites and consideration of the role of the regional ITS system in commuter rail operations.

For each segment of the Corridor, the CONSULTANT will apply representative unit costs, with pre-engineering consideration of major infrastructure requirements. Estimates for the individual project elements, by segment, will be summed for several major expense categories: civil works, tracks and signaling, rail vehicles, support systems, right-of-way, management and engineering, and contingencies.

Planning-level operating and maintenance cost methods will be derived to compare the alternatives. These will be based on the forecast ridership loads and other service-related factors and unit-cost factors from existing transit agencies, comparable in level of detail with the conceptual service plan for the Corridor.

PART III: REGIONAL HIGH CAPACITY TRANSIT CORRIDOR ANALYSIS

Task 10: Identify Alternative High Capacity Transit Service Concepts

Using the results of prior tasks, the CONSULTANT will identify alternative high capacity transit service concepts for existing rail corridors not feasible for commuter rail. Important criteria in developing these transit service concepts are the availability of width in these corridors and the potential continuity of these alternative services through extensions to other corridors. Existing non-rail right-of-way, such as freeway right-of-way and electric transmission line corridors, that has a potential for shared use with high capacity transit shall be considered as part of this analysis to help develop a functional high capacity transit system. An important issue to address will be whether high capacity transit service can be provided on existing rail lines using modes such as Bus Rapid Transit (BRT) or Light Rail Transit (LRT) since numerous grade separations may require vertical separation, particularly where they are close to major road intersections.

As a part of this task, the CONSULTANT will review prior and ongoing studies, including but not limited to the Tempe/Scottsdale Major Investment Study and the Chandler Major Investment Study, and recommendations on new regional high capacity transit corridors. Potential additional new high capacity transit corridors to meet projected travel demand may also be identified as part of this task. Alternative high capacity transit service concepts (light rail, elevated rail, bus rapid transit, etc.) applicable to the new corridor will be identified.

The service concepts will be developed to address the transportation corridor needs and deficiencies identified in Task 4, which includes flows in various corridors as projected by the MAG model. This process will examine each corridor and determine appropriate transit services that may be considered based on these needs and considering the characteristics of the corridor (land use , traffic, on-street parking, transit), constraints and projects of potential demand. Each service alternative will include conceptual descriptions of the technology of each system, the general alignment and corridors of operation, station spacing and locations and an overall operating strategy. In addition, supportive transit elements such as buss feeder systems and integration with commuter rail and other transit element swill be considered at the conceptual level in terms of their interactions with the high capacity transit network and the proposed LRT system in the MAG region.

Task 11: Refine Threshold and Performance Measures; Estimate Ridership, Operations, Maintenance and Capital Costs

The CONSULTANT shall refine the threshold and performance measures developed for high capacity transit modes created in Task 4 for their applicability to the alternative services identified in Task 11. Ridership and operating and capital costs of the alternative high capacity transit services identified in Task 10 will be determined. Support facilities and maintenance needs shall be incorporated into the cost estimates. The evaluation of the alternative service concepts should consider the disruption caused to the street network and additional costs to retrofit existing signal systems.

Task 12: Evaluate Alternatives; Recommend Feasible High Capacity Transit Options

The CONSULTANT will evaluate alternatives identified in Task 10 with the refined performed measures developed in Task 11. The evaluation of alternatives shall consider the relationship of the proposed alternatives with other transit modes, such as light rail, express bus and local bus. The evaluation of alternatives shall consider the relationship of the proposed alternatives to land use plans. Potential changes to land use plans that would enhance high capacity transit can be addressed as part of this task. An important consideration is the compatibility of modal options with the existing and planned transit system, and the ability to integrate alternative technologies into an efficient and effective regional transit system.

The CONSULTANT shall also analyze the potential population served by high capacity transit services to assure that Title VI and environmental justice concerns are addressed.

A systematic process will be used to assess each alternative and describe and quantify, where possible, the implications of each alternative using the evaluation criteria. Tables will be prepared to present and summarize these implications and a matrix-type analysis will be presented comparing the alternatives in terms of qualitative statements (e.g. good, fair, poor), graphics (e.g. shaded circles) and/or quantitative estimates (e.g. costs, level of service, etc.) The evaluation matrices will be described and interpreted in accompanying text, focusing on major trade-offs among the network options. For example, the network coverage and estimated ridership levels achievable with different levels of investment will be described in relation to operating costs, traffic level of service, and economic implications of the various options. Based on this evaluation, lines will be identified for a region-wide system of high capacity transit.

PART IV: REGIONAL HIGH CAPACITY TRANSIT SYSTEM PLAN

Task 13: Identify an Integrated High Capacity Transit Network and Define Preliminary Operating Characteristics

Based on the results of prior tasks, the CONSULTANT shall identify an integrated high capacity transit network and preliminary operating characteristics of the high capacity transit service. The stakeholders and agencies identified in Task 2 shall have input on the operating characteristics of the proposed service. The first step of this task will be to identify the major goals, in performance terms, of the high capacity transit network. Areas to be addressed include: overall and corridor modal split objectives; support for the regional economy and major activity centers; creation of balance and flexibility in the regional transportation network; and integration with other transit systems and elements to provide an effective family of transit services throughout the region. These goals will consider physical, operational, environmental and fiscal constraints.

Parts II and III of this work scope will define the preferred commuter rail and other high capacity transit services. Building on these findings and technical analysis, further refinements to the conceptual network will be considered. Special attention will be devoted to the level of coverage provided by the network (i.e. number and extent of corridors served) in relation to the required level of investment and estimated ridership levels. The supporting analysis will provide any necessary updates to previously defined operational and/or service considerations.

Drawing upon the results of the above, integrated networks will be developed showing the corridors covered and conceptually describing commuter rail/high capacity transit in each corridor in the following terms: typical cross sections; typical station concepts and related urban design elements; traffic and transit operational considerations; and transit feeder systems. It will be particularly important to identify feeder system relationships to demonstrate how the network serves the entire study area in an integrated manner. In addition, Potential termini of the system shall be identified, along with rights-of-way and the costs identified in Task 7. General locations for maintenance and storage facilities, additional park and ride lots, and transfer stations between commuter rail and other modes shall be identified. General operating characteristics, such as hours and frequency of service, will be identified.

The integrated network will also include a preliminary discussion of various policies and requirements to support the plan: land use/urban design, traffic/transit, institutional considerations and funding considerations.

Task 14: Estimate Ridership and Potential Revenues; Estimate Operating and Capital Costs

Based on the operating characteristics identified in Task 13, estimated ridership and potential revenues will be identified. Operating and capital costs of the high capacity transit network will be defined. The estimate of operations costs shall include the provision of high capacity transit service, additions to planned support transit services, such as neighborhood circulators, support facilities, maintenance facilities and plans, and vehicles. Capital costs will depend on factors such as hours of operation, train frequency, and the need for additional park and ride lots. As part of capital costs, track rehabilitation, ancillary improvements costs, associated equipment, cost of upgrading existing transfer sites and consideration of the role of the regional ITS in high capacity transit operations.

Task 15: Develop Implementation Strategies and Action Plan

The implementation strategy will include broad service strategies for the next five- and ten-year time frames, the types of high capacity transit services and associated transit priority schemes that should be considered, traffic improvement and mitigation measures, and the anticipated impacts of these strategies. Planning level capital and operating costs will be prepared to help assess the cost-effectiveness of the various strategies along with budgetary implications. Recommended priorities, phasing and costing by corridor will be presented in the following categories: immediate commuter rail and high capacity transit improvements (identifying any supportive short-term rail initiatives); high priority infrastructure-based solutions; immediate actions or policies to protect future options; high potential opportunities requiring institutional/policy change.

The CONSULTANT shall identify potential partnerships with stakeholders, public agencies and other interested parties. Potential joint ventures for economic development which may help offset infrastructure costs should be explored. The implementation strategy and action plan shall include options for addressing financing, operations, maintenance and capital costs, and phasing recommendations. Integration of commuter rail with existing and proposed freight operations shall be considered in the action plan. Issues, opportunities and constraints identified in prior tasks shall be summarized. Potential solutions to issues and constraints shall be identified. Successful approaches to governance shall also be addressed in this task, as well as possible approaches to preserving rail corridors proposed for abandonment.

A step-by-step action plan will be developed for the first three years, outlining the specific timing, responsibilities, operational/coordination issues between agencies, costs to implement, policy/bylaw requirements to implement and interactions with other activities. It is important that the short-term solutions are implementable, realistic and contribute to the achievement of the longer range vision.

High capacity transit services may be eligible for federal funding, subject to satisfying various criteria at the local level. For this reason, proposed transit alternatives will be compared against the Federal Transit Administration's New Starts Criteria for federal funding, and further work or studies needed to meet these requirements will be identified.

II. DELIVERABLES

The principal work products of this project are the five working papers, workshops and meetings as outlined in the PIP, and the Final Report. It is important to note that the CONSULTANT name or logo should not appear on the cover page of any document submitted to MAG; however, these may be included on subsequent pages. In preparing the working papers, it is expected that the CONSULTANT will first provide one (1) unbound copy and one (1) electronic copy of the initial draft document to MAG for internal review. The CONSULTANT will incorporate comments from the internal review into a revised working paper and submit one (1) unbound copy and (1) electronic copy for external review within two weeks of receiving MAG comments. The CONSULTANT will then address or incorporate all comments resulting from the external review and submit five (5) copies of the final working paper and (1) electronic copy to MAG.

Copy ready quality of all deliverables are required. Copies of all drafts and final papers and reports must also be delivered in electronic format (standard Corel or Microsoft office software). Copies must also be supplied in Adobe Acrobat portable document format (.pdf files), to facilitate distribution for comment.

The CONSULTANT will allow sufficient resources to meet with the MAG project manager as necessary and all activities identified in the PIP developed in Task 2. In addition to public meetings as identified in the PIP, there may be periodic updates to the MAG Transportation Review Committee (up to six), periodic updates to the MAG Management Committee (up to three), and presentations to the MAG Regional Council (up to three). Additional meetings shall be budgeted for in the public involvement plan as well, including periodic updates (up to eight) to the Valley Metro Operations Staff, the Agency Oversight Committee of the Central Phoenix/East Valley Light Rail Transit Project, and the RPTA Board of Directors.

The CONSULTANT will provide to MAG a draft copy of all materials to be presented at the workshops and meetings for review and comment at least three business days prior to the scheduled meeting. Comments received from MAG will be incorporated into the presentation materials prior to the presentation. The CONSULTANT will provide MAG with paper copies of all materials (e.g. slide shows) presented at the workshops and meetings. Slide presentations for the workshops and meetings should be prepared in Microsoft PowerPoint or Corel Presentations format.

All work products created during the course of this project become the property of MAG. Work products include, but are not limited to, written reports, graphic presentations, spreadsheets, databases, data files, computer programs, and support documentation. All Working Papers shall include an executive summary.

1. Working Paper 1: Project Schedule and Public Involvement Plan (one initial administrative draft in electronic and hard copy format for MAG review; and one electronic version and 5 copies of the revised Working Paper). This working paper shall include the items listed in Tasks 1, 2 and 3. The working paper will include a revised scope of work and detailed project schedule, the public and agency involvement plan, and the stakeholder list.

2. Working Paper 2: Needs and Opportunities (one initial administrative draft in electronic and hard copy format for MAG review; and one electronic version and 5 copies of the revised working paper). This working paper will summarize the data and accomplishments in Tasks 3, 4, 5 and 6, and address all the elements listed in these tasks. Items addressed will include a review of prior studies and a review of commuter rail and other high capacity transit service characteristics; thresholds and performance measures for commuter rail and other high capacity transit operation; travel demand modeling methods and socioeconomic forecast scenarios, and operational commuter rail and high capacity transit modeling system, and an inventory of existing rail facilities and issues associated with operating commuter rail in freight corridors.

3. Working Paper 3: Identification of Alternatives (one initial administrative draft in electronic and hard copy format for MAG review; and one electronic version and 5 copies of the revised Working Paper). This working paper shall include the elements listed in Tasks 7, 8 and 10. Items to be discussed include feasibility of commuter rail in existing corridors and potential changes to land use plans to enhance the feasibility of high capacity transit service; preliminary regional rail network, and alternative high capacity transit service concepts.

4. Working Paper 4: Evaluation of Alternatives (one initial administrative draft in electronic and hard copy format for MAG review; and one electronic version and 5 copies of the revised Working Paper). This working paper shall include the elements listed in Tasks 9, 11 and 12. Included will be ridership, potential revenues and costs of the preliminary regional rail network; evaluation criteria and performance measures, ridership and costs of alternative high capacity transit service concepts; and evaluation and recommended high capacity transit alternatives.

5. Working Paper 5: Regional Commuter Rail/High-Capacity Transit Plan (one initial administrative draft in electronic and hard copy format for MAG review; and one electronic version and 5 copies of the revised Working Paper). This working paper shall include all the elements listed in Tasks 13, 14, and 15. Included will be an integrated high capacity transit network and preliminary operating characteristics; ridership, revenues and costs of the high capacity transit network; and an analysis of opportunities and constraints, action plan and implementation strategies.

6. Final Report. The Final Report (one initial administrative draft in electronic and hard copy format for MAG review; and one electronic version and 5 copies of the revised Final Report) shall summarize the key results of the study in a highly communicative format suitable for different audiences, such as citizens and policy decision-makers. The Final Report shall include an executive summary intended for widespread distribution to diverse audiences.

III. SCHEDULE

It is anticipated that the study will commence on or about December ___ 2001, and be completed by December 31, 2002. It is important to note that the dates in the “Schedule for Completion “ column refer to the completion dates of initial draft documents for internal review by MAG.

TASK	SCHEDULE FOR COMPLETION
MILESTONE 1: PROJECT SCHEDULE AND PUBLIC INVOLVEMENT PLAN	January 30, 2002
1. Refine the Work Scope	
2. Develop Public and Agency Involvement Plan	
3. Review Prior Studies and Conduct Review of High Capacity Transit Characteristics	
MILESTONE 2: NEEDS AND OPPORTUNITIES	June 30, 2002
4. Identify and Refine Thresholds for Commuter Rail and Other High Capacity Transit Operations	
5. Develop Travel Demand Modeling Methods and Identify Socioeconomic Forecast Scenarios	
6. Inventory Facility and Operational Characteristics and Issues of Existing Rail Corridors in the Region	
MILESTONE 3: IDENTIFICATION OF ALTERNATIVES	July 31, 2002
7. Assess Feasibility of Commuter Rail Service in Existing Corridors and Identify Feasible Commuter Rail Corridors	
8. Define Regional Commuter Rail Network and Preliminary Operating Characteristics	
10. Identify Alternative High Capacity Transit Service Concepts	

TASK	SCHEDULE FOR COMPLETION
MILESTONE 4: EVALUATION OF ALTERNATIVES	September 30, 2002
9. Estimate Commuter Rail System Ridership and Potential Revenues; Estimate Operating and Capital Costs	
11. Refine Threshold and Performance Measures; Estimate Ridership, Operations, Maintenance and Capital Costs	
12. Evaluate Alternatives; Recommend Feasible High Capacity Transit Options	
MILESTONE 5: REGIONAL COMMUTER RAIL/HIGH-CAPACITY TRANSIT PLAN	December 31, 2002
13. Identify an Integrated High Capacity Transit Network and Define Preliminary Operating Characteristics	
14. Estimate Ridership and Potential Revenues; Estimate Operating and Capital Costs	
15. Develop Implementation Strategies and Action Plan	December 31, 2002
MILESTONE 6: FINAL REPORT	December 31, 2002

1.2 Public and Agency Involvement Plan

1.2.1 Introduction

This Draft Public Involvement Plan provides an overview of public involvement objectives for the Maricopa Association of Governments (MAG) High Capacity Transit Plan, as well as specific actions that will be carried out by the consulting team in association with MAG staff.

Study Overview

The purpose of the MAG High Capacity Transit Plan is to evaluate the feasibility of commuter rail along existing rail corridors and to look at other high capacity alternatives for existing rail corridors where commuter rail is not feasible. The outcome of the study will be to create a High Capacity Transit Plan that also includes new high capacity transit corridors in areas without existing rail corridors. The Plan will include a schedule that identifies roles and responsibilities for implementing the recommendations, as well as funding opportunities.

The study will be conducted in four parts:

- **The first part** is a series of general and start-up tasks that include the review of past and ongoing studies, developing thresholds for commuter rail and other high capacity transit operations, and demand forecasting/socioeconomic modeling.
- **Part Two** includes the analysis of commuter rail accessibility and feasibility, as well as service characteristics and ridership projections.
- **Part Three** is the regional high capacity transit corridor analysis to identify new service concepts appropriate for non-commuter rail corridors. This includes the development of service characteristics, ridership and cost projections.
- The High Capacity Transit Plan, **Part Four**, is the strategic plan identifying service options, financial requirements, implementation strategies and responsibilities.

Although much of this project requires extensive technical work and evaluation by MAG staff and the consulting team, the public plays an important role in making this study a success. Fully 20 percent of the study budget is dedicated to the public involvement process. Public involvement affords the community an opportunity to participate in the planning process.

Of key importance to the success of the study is active public involvement which enables MAG to anticipate contentious issues and plan for them. When all parties are cooperatively and regularly involved, they must work together. The expected result is that even a potentially controversial High Capacity Transit Plan will be supported by a coalition of organizations and political leaders that is as diverse as the population of the MAG region.

The Public Involvement Plan

A Public Involvement Plan (PIP) allows MAG to offer various forms of input, as well as provide outreach to citizens of the MAG region, political leaders, social service organizations, special interest groups and other agencies and organizations. Hence, plans that are ultimately developed and endorsed reflect not only the values and interests of MAG staff and the Regional Council, but also of the MAG region as a whole.

Numerous benefits can be derived from designing and implementing an effective PIP. Objectives in developing this PIP include the following:

- Incorporate a variety of community interests, including the rapid-growth communities within the MAG region.
- Afford community decision-makers the opportunity to share points of view on regional growth, transportation policies, and the future of commuter rail in the Phoenix area.
- Prioritize key issues and build consensus.
- Educate others on the complex decisions required to develop high capacity transit solutions within the large study area.
- Establish marketing and educational partnerships within the MAG region.
- Bring diverse organizations with similar purposes together.
- Tap the experience of other organizations in addressing the concerns of the community.

Importance of Information Exchange

The Public Involvement Plan for the High Capacity Transit Plan takes a three-tiered approach to optimize public participation in the planning process. The approach we provide for this study is as follows:

- **Listen to the community.** Gather useful information by talking with key players. The goal is to get all of the issues "on the table" early in the study process. This way, all concerns can be addressed at each stage of the High Capacity Transit Plan.
- **Integrate information.** Work with local organizations to share recommendations as the study progresses. Provide interagency coordination to ensure consensus is maintained throughout the study process.
- **Share information.** Provide informative, comprehensive information to the public. Showcase the public involvement process within the region.

The result of this approach is a comprehensive PIP. The key elements of this strategy are identified in the Action Plan for Public Involvement.

1.2.2 Action Plan for Public Involvement

The Action Plan identifies specific strategies to address the three-tiered approach described in the previous section.

Obtain Input/Comments through Stakeholder Interviews

Ultimately, to better inform the public and solicit useful feedback as part of the planning process, it is necessary to obtain input from individuals within the community. To initiate the study, we will conduct a series of stakeholder interviews with political leaders, business organizations, transportation operators and community representatives.

Identify Stakeholders (Individuals and Organizations/ Groups)

A preliminary list of individuals and organizations has been developed. Table 1.2-1 identifies potential stakeholders in the High Capacity Transit Plan process.

Table 1.2-1 **High Capacity Transit Plan Stakeholders**

Stakeholder	Title	Agency
Grant Anderson	Deputy City Manager	City of Goodyear
Shirley Berg	Assistant City Manager	City of El Mirage
Joe Blanton	Town Manager	Town of Buckeye
Jim Book	Public Works Director	City of Glendale
Diane Brossart	Member	Valley Forward
Tom Buick	Chief Public Works Officer	Maricopa County
Betsy Buxer	Transportation Project Director	The Community Forum
Fred Carpenter	City Manager	City of Wickenburg
Jim Dickey	Deputy Executive Director of Operations and Planning	Regional Public Transportation Authority
Ken Driggs	Executive Director	Regional Public Transportation Authority
Judy Eisenhower	Executive Director	Arizona Rail Passenger Association
Wulf Grote	Deputy Executive Director (LRT Project)	Regional Public Transportation Authority
Miryam Gutier	Intergovernmental Liaison	City of Surprise

Stakeholder	Title	Agency
Terry Johnson	Transportation Planning Manager	City of Glendale
Michelle Korf	Transportation Director	City of Scottsdale
Patrice Kraus	Intergovernmental Liaison	City of Chandler
Joe Lane	Member	Arizona Department of Transportation, State Transportation Board
Jeff Martin	Intergovernmental Liaison	City of Mesa
Sharon B. Megdal, PhD	Co-Chair	Governor's Vision21 Transportation Task Force
David Moody	Public Works Director	City of Peoria
Joe Neblett		Arizona Department of Transportation
Mary O'Conner	Deputy Public Works Director	City of Tempe
Michael Powell	Grants Coordinator	Avondale
Mark Reddie	Transit Development Manager	City of Phoenix
Tami Ryall	Intergovernmental Liaison	City of Gilbert
Suzanne Sale	Senior Financial Advisor	FHWA, Office of Budget & Finance
Bill Sapper		Arizona Department of Transportation
Martin L. Shultz	Co-Chair	Governor's Vision21 Transportation Task Force
David Schwartz	Executive Director	Friends of Transit
Garret Smith	Chair	Mesa Transit Advisory Board
Ed Zuercher	Public Transit Director	City of Phoenix

Through meetings with MAG staff and discussions with the stakeholders, this stakeholder list will be revised and modified.

Outreach to Rail Owners and Operators of Rail Freight and Passenger Service

As the owners of the major railroad lines located in the MAG region, the Burlington Northern Santa Fe (BNSF) and Union Pacific (UP) railroad companies will be important stakeholders in the development of the High Capacity Transit Plan. BNSF and UP will be involved early in the development of the High Capacity Transit Plan in order to establish the potential availability of the railroad corridors for high capacity transit service. Extensive consultation between these railroad companies, the consulting team, and MAG staff must occur in order for existing rail corridors in the region to become and remain viable high capacity transit corridors.

We propose to hold several briefings and one-on-one interviews with both BNSF and UP throughout the study process. The purpose of these interviews and briefings is to ensure that the railroad companies are knowledgeable about proposed transit improvements located in their rail corridors and, in turn, that the study team is up-to-date on current freight operations issues and constraints. These transit services proposed as part of the High Capacity Transit Plan will also need to be coordinated with existing freight rail traffic. This coordination effort will require consultation with BNSF and UP during the study process to ensure that freight rail trains and the proposed transit services will be able to operate within the same corridors.

Contact will also be made with representatives from Amtrak, which provides passenger rail services within the State of Arizona. While passenger service is currently only available south of the MAG region, future service within the MAG region may be possible. High capacity transit services proposed along the rail corridors could be coordinated with planned future intercity rail service to enhance passenger rail service in the MAG region.

Stakeholder Interviews and Questionnaires

Prior to the interviews, we will develop an Interview Guide, with input from MAG and the Planning Team, in order to ensure that the time will be spent most productively. The purpose of the interviews will be to understand the stakeholders' perceptions of commuter transportation needs, advantages of investing in these services, "hot-button" issues, potential pitfalls of proposed high capacity transit services, and likely controversies. Stakeholders will be asked to identify persons and organizations that would be likely allies, as well as potential adversaries.

The consulting team will conduct up to 40 stakeholder interview sessions. To increase the number of stakeholders, we could conduct small group meetings with two or three stakeholders participating at each meeting. Stakeholders will be assured that their responses will not be attributed to them in the summary report. Thus, they can speak in confidence. Although a limited number of interviews may be conducted by telephone, representatives of our outreach team will conduct most of the interviews in face-to-face meetings.

Following the stakeholder interviews, we will prepare a technical memorandum that provides a summary of the key issues, concerns and opportunities identified by stakeholders.

Project Newsletter #1

We will design a graphically interesting and informative newsletter that MAG can distribute to stakeholders. This will be the first of three project newsletters that will be developed during the study period. The newsletter will highlight the following:

- Identify the objectives for the High Capacity Transit Study,
- Summarize the study process and expected outcomes,
- Review the concerns of the stakeholders interviewed as part of the first phase in the study, and
- Describe next steps and opportunities for public input.

Provide Information to Community Leaders and Decision-Makers

Part Two of the study, the Commuter Rail Analysis and Part Three, the High Capacity Transit Corridor Analysis, will identify a number of feasibility issues, constraints, ridership and revenue estimates and provide a preliminary overview of the recommendations that may eventually be developed into the High Capacity Transit Plan. It is during this period that recommendations from other studies and ongoing planning activities must be integrated. By keeping business and community organizations, cities, towns, and the general public informed of key findings and outcomes of the study, we will remain apprised of both complementary and conflicting efforts that may affect the outcome of this study.

Identify Scheduled Meetings for Key Community/Planning/Business/ Political/Activism Groups

Based on conversations with stakeholders and staff input, we will prepare a calendar of meetings for key stakeholder organizations. The purpose will be to allow us to schedule presentations at these meetings to update their membership about the High Capacity Transit Plan. We will update this calendar periodically throughout the course of this study.

Present Study Objectives and Issues at Community Meetings

Based on the project budget, the consulting team will conduct up to 15 presentations at meetings throughout the MAG region. We will also develop a speaker's kit so that MAG staff or other individuals may present study milestones and findings at additional meetings. This is described later in the document.

Develop Media Kit of Issues and Opportunities

The consulting team will prepare a media kit that can be mailed or distributed to media representatives at special events. The media kit will comprise a comprehensive packet of information about the High Capacity Transit Study:

- Question and Answer Sheet (Frequently Asked Questions)
- Press release(s) regarding study milestones and public involvement efforts.
- Black and white and color reproduction of study logos, maps, and other graphics.
- Quotes from MAG representatives, politicians and community leaders.

Project Newsletter #2

The second project newsletter to be sent to stakeholders — including organizations to whom we made presentations during this phase of the project — will include an update on project progress, the organizations involved in the public involvement process, and preliminary recommendations from the study, as available. Project outcomes will also be summarized in *The MAGAZine*, MAG's quarterly newsletter.

Provide Information to and Obtain Comment from General Public

During Part Four of the study, the public involvement objectives shift from gathering information from key players and coordinating efforts, to bringing the general public on board. Although regular media updates, the Web Page and the newsletters will — to an extent — keep the public apprised of study milestones to date, the purpose of this new effort is to provide a direct opportunity to share project details. The public will have a forum to speak with project planners, MAG staff, and other local decision-makers. This will be achieved through a series of public open houses.

Prepare Summaries and Findings of Study to Date

In preparation for the public open houses, the consulting team will summarize key study findings and conclusions. Although summaries will provide technical information such as modeling results, ridership and cost projections, the information will be prepared in a comprehensive, easy-to-understand format. This information will be presented on graphic boards, maps, and through a slide presentation. We will "package" this information so that it can be displayed at a series of public open house meetings.

Conduct Public Open House Meetings

The consulting team will conduct up to five public open house meetings throughout the MAG region. This assumes that one meeting will be held per day over a period of up to five consecutive days. The effort highlights MAG's commitment to address the individual needs of local jurisdictions. Meetings will be publicized in letters to stakeholders, newsletters, public notices, the MAG Web site, *The MAGAZine*, press releases, in newspaper advertisements and through local media participation. We anticipate that the open houses will be conducted during early evening hours, allowing interested persons to attend on their way home from work. The informal format of boards/posters, slide shows and models will allow individuals to assess their own areas of interest and to speak one-on-one with project planners, engineers and representatives of local agencies.

Collection and Summary of Public Comments, Summary of Open House Meeting Outcomes

Although the open houses will provide an opportunity for the public and media to learn more about study findings and recommendations, they also provide a forum for soliciting comments. We will prepare comment cards for the open houses and gather input in written and verbal formats, compile it and provide a summary memorandum of the specific issues highlighted at each of the open houses.

Project Newsletter #3

The final newsletter of the study process will highlight not only the study findings, but also the public open houses and the role of the public in the review and decision-making process. Summary data and key comments from the open houses will be presented, along with the next steps in the process, including approval/endorsement of the plan, financing and eventual implementation.

Ongoing Public Information Resources

Throughout the process of obtaining information from the public and providing information to stakeholders, additional resources will supplement the specific tasks identified in the previous sections.

Project Web Page

The consulting team will provide project information, materials, and updates to MAG. This information will allow MAG to establish a project Web page. The Web page can be updated as needed throughout the study process. The Web page could showcase the following:

- Study overview,
- Meeting dates and locations,

- Key study personnel and how to contact them,
- Project milestones, findings and outcomes,
- Links to media coverage on the High Capacity Transit Study, and
- Information about how to get involved and how to provide comments on the study.

Existing MAG Committees

Individuals serving on existing MAG committees will be invited to inform the project team of separate studies and their outcomes. Members of other committees will be included in project organization meetings and milestone meetings throughout the High Capacity Transit Study process. The High Capacity Transit Study team and MAG staff will make regular presentations and provide informational updates to other MAG committees to keep them informed of the project progress.

Speaker's Bureau

Although the consulting team will make presentations to a number of local organizations, business groups and MAG committees, we anticipate that other occasions will arise when it will be beneficial for others to present information about the High Capacity Transit Study. Because we cannot yet anticipate the demand for presentations about the study, we will prepare a Speaker's Kit that can be used by MAG staff or others. The Speaker's Kit will include updated information about the study, handouts of commonly asked questions and study findings, an informative PowerPoint presentation highlighting study milestones and next steps, and other resources as needed. The consultant and MAG staff will work together to determine how this kit can be used as part of a Speaker's Bureau.

Ongoing Media Outreach

We will update the press kit developed during the Issues and Opportunities phase of the study. The consulting team will work with the MAG Public Information Office and MAG staff to provide press releases to the media contacts developed early in the study process. The objective is to maintain an ongoing positive public awareness of the study — one that will encourage an anticipation of next steps and rally support for the possible outcomes. MAG and consulting team staff will provide assistance in responding to not only media concerns, but also to public questions and issues identified by individual and organizational stakeholders.

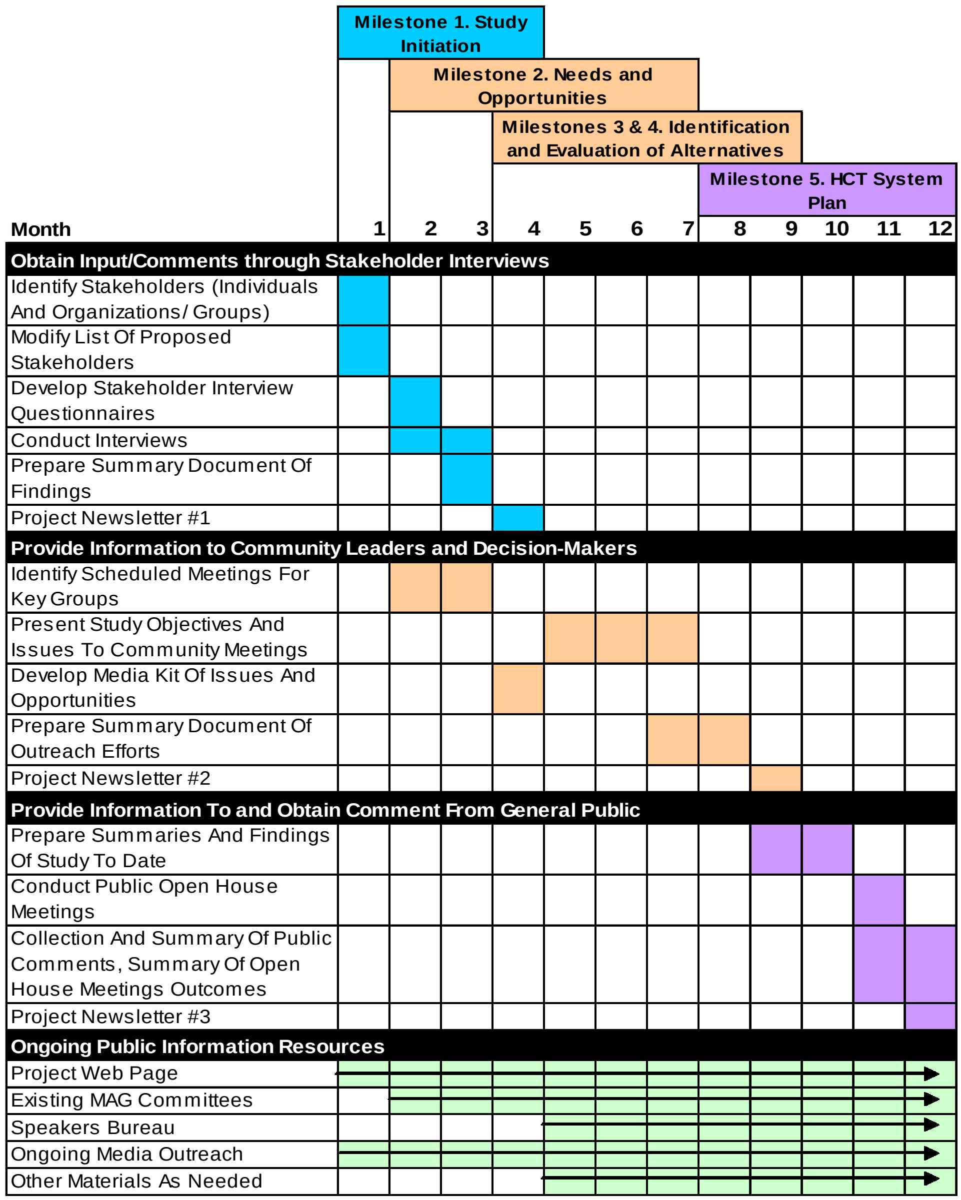
Other Materials As Needed

Other public information resources — both printed and electronic — will be made available to MAG staff, the media, stakeholders and the general public as needed. While every effort is being made though the implementation of this PIP to gather input from all players and keep them informed, unforeseen circumstances might arise where additional meetings, interviews and outreach efforts are needed. A limited number of resources have been budgeted by the consulting team to address unforeseen needs.

1.2.3 Time Line

Exhibit 1.2-1 illustrates a proposed implementation time line for the Public Involvement Plan.

Exhibit 1.2-1 **Public Involvement Plan Implementation Timeline**

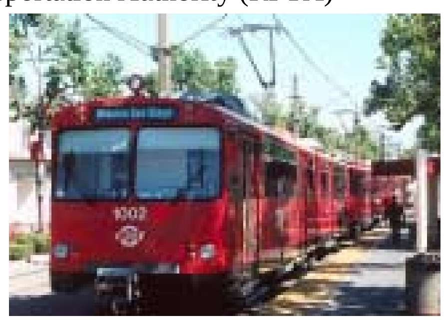


1.3 Review of Transportation Studies

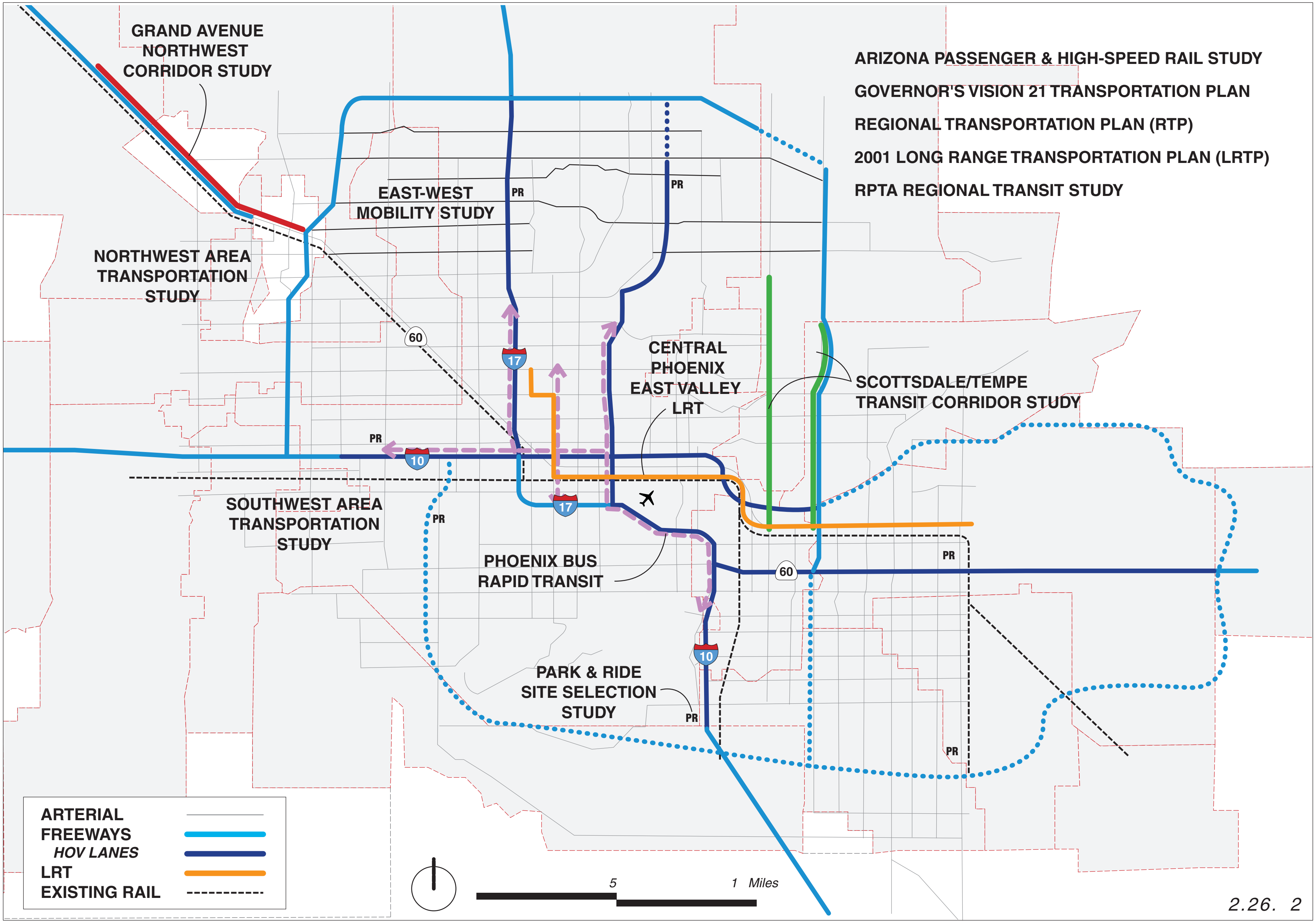
1.3.1 Introduction

The Maricopa Association of Governments (MAG) and local cities within the MAG region have undertaken several transportation studies during the past few years to determine ways to enhance and expand the regional transportation network. As one of the fastest growing metropolitan areas in the United States, the MAG region is facing increasing traffic congestion as a result of growing population and employment levels. Some of the more recent regional transportation studies which will be studied during the development of recommendations for the MAG High Capacity Transit Plan include the Scottsdale/Tempe North/South Transit Corridor Study, the Governor's Vision 21 Transportation Plan, and the Park & Ride Site Selection Study. Statewide transportation studies will also need to be considered during the development of the MAG High Capacity Transit Plan, including several passenger rail studies conducted by the Arizona Department of Transportation (ADOT). Several past studies such as the MAG Fixed Guideway System Study and RPTA Commuter Rail Demonstration Project will be reviewed for information and findings that could be incorporated into the High Capacity Transit Plan.

Study efforts currently underway include the City of Chandler High Capacity Transit Major Investment Study (MIS), the MAG Regional Transportation Plan, the Regional Public Transportation Authority (RPTA) Transit System Study, and the East/West Mobility Study. The recommendations of the High Capacity Transit Plan must also be coordinated with two major transit projects currently under development in the MAG region. These projects are the Central Phoenix/East Valley (CP/EV) Light Rail Transit (LRT) line and the City of Phoenix Bus Rapid Transit (BRT) project. Both projects will facilitate the movement of commuters into and through Downtown Phoenix, with the LRT line providing additional service to Downtown Tempe and Mesa. The recommendations from the RPTA Transit System Study will also be important due to the linkages between high capacity transit service and local bus service.



This section provides a summary of the transit studies currently underway and those recently completed in the MAG region. Major upcoming project milestones are provided for transit projects and studies currently under development. Additionally, the potential relationship between these studies and the MAG High Capacity Transit Plan is discussed. Exhibit 1.3-1 illustrates the current transportation studies and projects underway in the MAG region.



TRANSPORTATION STUDY FOR *MAG* MAP

IBI GROUP

Maricopa Association of Governments

1.3.2 Transportation & Transit Studies

Arizona Passenger and High-Speed Rail Studies

Several studies have been produced by ADOT working in partnership with various agencies in the State of Arizona, researching the feasibility of expanding passenger rail service in the state. The first of these studies to be discussed here is the 1993 *Arizona Rail Passenger Feasibility Study*. This study examined rail service throughout the state and found very few areas capable of supporting new passenger rail service. One area which did rank well and received a recommendation for further study was a commuter rail line connecting the Cities of Glendale and Mesa through central Phoenix. This corridor was analyzed further in the *Arizona Rail Passenger Feasibility Continuation Study* completed in 1994. The commuter rail line proposed in the previous *Arizona Rail Passenger Feasibility Study* was extended to run from Peoria to Mesa. Cost estimates, revenue projections, and station locations for the proposed 33-mile alignment were also identified.

A third rail passenger study relevant to the current High Capacity Transit Plan is the *Arizona High Speed Rail Feasibility Study*. The Union Pacific rail line and Interstate 10 corridor between Phoenix and Tucson were the focal points of this study, which looked at several forms of high-speed rail transportation to link these two metropolitan regions. Recommendations from this study involve the upgrading of the freight rail tracks to support passenger service, with additional upgrades performed in the future to support high-speed rail operations.

The recommendations of these studies will be analyzed during the preparation of the High Capacity Transit Plan. The cost estimates and revenue projections prepared in these studies may serve as a base for rail transit services proposed in this study. The potential use of the Union Pacific rail corridor for high-speed rail service may influence other recommended High Capacity transit services in this corridor. Additional review of the study recommendations will occur as specific transit corridors are identified in the High Capacity Transit Plan.

2000 Arizona State Rail Plan Update

This update to the Arizona State Rail Plan was completed by the Arizona Department of Transportation (ADOT). The state rail plan contains many components including information on the history railroad services and funding within the state, a full inventory and status of existing rail lines and freight and passenger rail services, needs and opportunities for enhancing capital facilities and rail service, and future needs for the statewide rail network.

Existing freight and passenger rail services are inventoried and analyzed in this document. Information pertaining to existing rail operations within the MAG region will be collected for use in defining proposed services in the High Capacity Transit Plan. Commuter rail services planned within existing rail corridors must coordinated with the existing freight rail service in the MAG region.

The status of each of the major Class I rail facilities owned by the Burlington Northern Santa Fe (BNSF) and Union Pacific (UP) railroads are included within the state plan. Information about daily train frequencies, speeds, passenger stations, and rail yard capacity is included. This information will be compared with service details obtained from the railroad companies themselves. The inventory of existing conditions and rail traffic on these lines will provide background during the development of potential transit services within the rail corridors.

Several recent rail plans which analyzed intercity and commuter rail passenger service were as reviewed in this study including:

- Statewide Rail Passenger Study (1992)
- Phoenix to Tucson High Speed Rail Study (1997)
- Rail Corridor Demonstration Study (2000)
- West End Phoenix Subdivision Study (2000)

The 1992 Statewide Rail Plan identified four potential intercity or commuter rail services within the State of Arizona:

- Phoenix to Tucson Intercity Rail
- Tucson to Nogales Intercity Rail
- Phoenix East Valley Commuter Rail
- Phoenix Northwest Valley Commuter Rail

Intercity service between Phoenix and Tucson was selected as the top priority corridor with a proposal for five trains running between the two cities each day. The recommendations from this study have yet to be implemented.

The 2000 West End Phoenix Subdivision Study analyzed the abandoned Union Pacific rail line west of downtown Phoenix. This study estimated that the capital cost of improving the rail line to implement passenger rail service in this corridor would be approximately $23 million.

Further evaluation of rail corridors in the MAG region is included within the 2000 State Rail Plan Update. The Burlington Northern Santa Fe

(BNSF) Grand Avenue corridor was considered to have good potential as a commuter rail corridor. However, several physical constraints were identified including the six leg street intersections and the possible need to double track the rail line in order to accommodate freight and passenger rail services. Two major concerns were identified for the east and west Union Pacific rail corridors within the MAG region. Similar to the BNSF Grand Avenue corridor, freight and passenger rail service may create a need for double-tracking the rail lines. Also, the rail line corridor east of downtown Phoenix has several portions with severe speed limitations. Upgrades would be required to increase service speeds.

Governor's Vision 21 Transportation Plan

The Vision 21 Transportation Plan Task Force began work in 1999 on the development of several recommendations to improve the statewide transportation planning process in Arizona. Ten major recommendations were submitted by the Task Force to the Governor in a final report submitted in December 2001. The major recommendations of the Vision 21 Transportation Plan Task Force were:

- Require Performance-Based Planning and Programming of Projects
- Develop and Adopt a Long-Range, Statewide, Multimodal Transportation Plan
- Coordinate Land Use Planning and Transportation Planning
- Establish Comprehensive Financial Management
- Establish Urban Regional Transportation and Land Use Districts
- Strengthen the Arizona Transportation Board
- Increase Dedicated Transportation Revenues
- Prioritize System Preservation
- Prioritize Congestion Relief and Commuter Services
- Implement Immediate and Obvious System Improvements

These recommendations include the development of statewide criteria to evaluate the benefits of proposed projects and determine if the projects are appropriate for implementation given their projected benefit. Increased coordination between land use and transportation planning is also recommended to ensure that the transportation and transit network is able to adequately serve new development.

A common theme present in the recommendations presented by the Governor's Task Force is a more multi-modal emphasis in statewide transportation planning. Rail transit and other forms of regional transit are gaining prominence in the State of Arizona as viable alternatives for improving regional mobility. The Task Force recommendations reflect this new emphasis on transit and multi-modal transportation, increasing the ability for regional High Capacity transit projects to receive funding through the State and Federal programs.

Recommended project alternatives proposed in the High Capacity Transit Plan should have characteristics which allow the projects the opportunity to fare well in the proposed statewide project evaluation process outlined in the Vision 21 recommendations. As these evaluation processes become more refined, they will be researched to ensure that the projects proposed in the High Capacity Transit Plan would rank well enough to have an opportunity to receive state funding.

Regional Transportation Plan (RTP)

MAG is undertaking an effort to prepare the Regional Transportation Plan (RTP) for the MAG region. The RTP is a document outlining regional transportation improvements and funding allocations for proposed improvements. Elements included in the preparation of this document include the identification of population growth trends in the region during the next 25 years and an evaluation of the impact that population growth will have upon the planned regional transportation system.

This document serves as the overall authority for the planning and financing of transportation projects in the MAG region. The projects included in this document are designed to meet the transportation needs for the existing and projected residents of the MAG region. All other major transportation projects and studies being conducted in the region must be consistent with the plans and policies set forth in this document.

Phase 1 of this project involved the identification major social, land use, environmental issues affecting transportation in the MAG region and extensive outreach to community groups and local agencies. Major transportation issues were identified through the development of several issue papers focusing on each of the major issues and through discussions and input received from the participants of several transportation expert panel discussions held throughout the MAG region. The results of the public outreach, expert panel forums, and issues papers will be incorporated into a State of Region report outlining the existing transportation system and the needs for transportation improvements given project population and employment increases and planned land use. Phase 1 of the RTP is scheduled to be completed in Spring 2002.

As part of the public outreach portion of Phase 1 more than a dozen workshops were conducted with a variety of focus groups from throughout the MAG region. The focus groups included representatives from different subregions within the MAG boundaries, members of the African-American and Hispanic communities, and local agencies. Each focus group was asked to vote on the most important transportation issues facing the MAG region from five topic areas:

- Demographic and Social Change
- The New Economy
- Environmental and Resource Issues
- Land Use and Urban Development
- Transportation and Technology

Major issues selected by several focus groups include providing improved transit service for the elderly, improving air quality, expanding the transportation infrastructure to accommodate new growth, and providing more transit alternatives. The results of the targeted focus group information will be studied to gain a sense of neighborhood and subregional issues as specific transit corridors are identified in High Capacity Transit Plan.

Phase 2 of the RTP will begin in middle to late 2002. This second phase of effort will focus on specific projects that will enhance the transportation network in the MAG region. Possible funding sources will also be explored for the projects identified in this phase. Many of the other studies listed in this section are being produced to assist in the development of the RTP Phase 2. The Northwest, Southwest and Southeast Area Studies, along with the Scottsdale/Tempe North/South Transit Corridor Study, the City of Chandler Transit MIS, and the High Capacity Transit Plan will identify specific corridors for transportation improvements. The recommendations of these studies will be incorporated in the RTP, along with other recommendations developed during the production of the Phase 2 study effort.

2001 Long Range Transportation Plan (LRTP)

Each year, regional Long Range Transportation Plan (LRTP) is updated to reflect new short and long-range transportation projects planned by the jurisdictions in the MAG region. The 2001 edition of this document contains the planned transportation projects within the MAG region through 2021. The LRTP is fiscally constrained, meaning that the projects included in it have already secured funding or are reasonably expected to obtain funding.

New projects added to the Regional Transportation Plan (RTP) currently under development will be included in this document as funding sources are identified. Any improvements recommended during the development of the High Capacity Transit Plan will also be included in future updates to this document as funding becomes available.

The 2001 LRTP contains a substantial amount of improvements to the region's transportation and transit infrastructure. Improvements to the regional freeway system include the completion of all programmed new freeways by 2007, the addition of high occupancy vehicle (HOV) lanes to I-17, SR-51, and US-60, and the construction of additional mixed-flow lanes on several other freeways including I-10, I-17 and SR-85. Improvements to the regional arterial roadway system are also planned during the 20-year funding period in the LRTP.

Several transit improvements are contained in the LRTP. Funding is identified to provide for the tripling of local bus and dial-a-ride service, the quadrupling of express bus service, and completion of a 39-mile light rail transit (LRT) system. Enhancements to local and express bus services will include expanded hours of service, more frequent service, larger service areas, and additional routes. Given that these improvements are funded and planned for implementation, it will be essential that the recommendations of the High Capacity Transit Plan be able to integrate with these expanded transit services.

Regional Public Transportation Authority (RPTA) Commuter Rail Demonstration Project

The Regional Public Transportation Authority (RPTA) conducted a commuter rail demonstration project in 1995 to examine the feasibility of providing commuter rail service for a short period of time in the MAG region. The objective of this demonstration project was to assess the demand for commuter rail service within the MAG region. Two corridors were selected for participation in the demonstration plan. The West Valley corridor extended from Downtown Phoenix to Litchfield Road. The East Valley corridor extended from Downtown Phoenix to Chandler. Both corridors utilized the existing Union Pacific rail line.

The East Valley line consisted of a single morning peak hour train and a single afternoon peak hour train. West Valley services were provided by two morning peak hour trains and two afternoon peak hour trains. Each line was proposed to run for one month during separate months. This offset operation was chosen to reduce conflicts with Amtrak passenger rail services and reduce the number of rail vehicles required for procurement to operate the service. Each of the two rail corridors was evaluated for potential stations, maximum train operating speeds and conflicts with existing freight and passenger rail services.

The analysis of operations included an assessment of potential conflicts with existing freight and passenger rail services, comparisons between rail travel time and automobile travel time in parallel corridors, and a review of the existing track conditions and maximum train operating speeds. Over fifty percent of the rail line corridor east of downtown Phoenix was found to have speed limitations of less than 25 miles per hour.

The proposed RPTA Commuter Rail Demonstration Project did not enter operation. However, there have been two other commuter/passenger rail service demonstration projects which have occurred in the MAG region. In 1980, a short-term commuter rail line was placed into emergency operation to transportation commuters across the flooded Salt River in Tempe. Once automobile passage across the river was reinstated, the emergency commuter service was discontinued. A second demonstration occurred in 1998, involving the transportation of passengers from the East Valley to Bank One Ballpark in Downtown Phoenix. The passengers attended two Arizona Diamondbacks baseball games on April 18 and April 19, 1998. Both trains sold all available tickets. While this demonstration was not a true commuter rail demonstration, it provides an example of a willingness of residents in the MAG region to travel by train to special events. Several existing commuter rail operations offer special event service to sporting events and concerts including those operating in Los Angeles and Dallas. These events can be beneficial in generating awareness about the commuter service and possibly attracting ridership during normal commute operations.

The Arizona Passenger Rail Association (APRA) sponsored the operation of the Arizona Rail Express demonstration service between Phoenix and Tucson in 1993. This group has been very active in supporting the implementation of passenger and commuter rail service. The results of this project and other research gathered by the APRA will be studied for application to the development of the High Capacity Transit Plan.

Both of the rail corridors studied by the RPTA commuter rail project will be considered for high capacity transit service. As such, the recommendations of this demonstration project as well as the results of the two previous passenger rail demonstrations operated in the MAG region will analyzed during the development of recommendations for the High Capacity Transit Plan.

Express Bus Study

This study was prepared in 1996 by the City of Phoenix Public Transit Department and Regional Public Transportation Authority to address the changing landscape of employment destinations with the MAG region and reverse a recent trend of declining express bus ridership. Employment centers expanding to areas outside of the central Phoenix downtown reduced the effectiveness of express bus service focused on delivering riders to downtown Phoenix and adjacent employment centers.

The study focused on developing ways to enhance express bus service to increase ridership and serve a larger portion of the region's population. Extensive public outreach was conducted with existing express and local bus riders to identify the characteristics and preferences of typical riders. The information gathered from the public outreach efforts was used to target new or expanded services in areas where larger numbers of express bus riders might reside.

The outreach results were combined with information gathered from peer group express bus services in other metropolitan regions to develop a series of short-term service changes and enhancements designed to increase ridership and service area coverage.

An analysis of the largest 21 employment centers within the MAG region was also completed for this study. The 6 employment centers listed below were determined to be the largest in terms of total number of persons employed. In 1995, each of these locations offered over 30,000 employment positions:

- Phoenix Uptown
- Phoenix Downtown/State Capital
- Sky Harbor Airport
- Phoenix Camelback Corridor
- Tempe Downtown/Industrial Center
- Phoenix Metrocenter

The Uptown and Downtown Phoenix locations were the most common terminus points for express bus services. New high capacity transit services should be designed to serve these major employment centers as well as some of the other employment centers identified in this system which possess high densities of employment such as Downtown Scottsdale and the Chandler Industrial/Office Center.

The express bus rider profiles developed in this study will be analyzed during the development of the High Capacity Transit Plan. As current transit users, they would be prime candidates to utilize other forms of long distance high capacity transit services such as commuter rail and Bus Rapid Transit. The detailed assessment of express bus rider characteristics conducted for this study discovered several pertinent findings which could be applied to the High Capacity Transit Plan:

- Ninety percent of express bus riders travelled less than four miles to their bus stop/station
- Walking and driving were the most common methods of arriving at the bus stops/stations
- Many riders expressed a need for extended service schedules and improved amenities on the buses

Recommendations to enhance express service included increased marketing of services, additional park and ride lots, new buses, improved amenities on the buses and a reduced number of stops to improve travel time. The study also recommended that existing and new routes take full advantage of existing and proposed high occupancy vehicle (HOV) lanes to improve travel times. New routes were not proposed as part of this update. This category of improvement was planned for a future study effort.

Central Phoenix/East Valley MIS

The Central Phoenix/East Valley (CP/EV) Major Investment Study (MIS) was undertaken to develop and implement a major fixed transit system within the MAG region. The MIS study area was located within the cities of Phoenix, Tempe, and Mesa, within an area defined as the Highest Demand Corridor (HDC). This corridor contained a large amount of unmet travel demand and congestion levels at the time the MIS was produced in 1998. These travel demands and congestion levels were still expected to be present in the year 2020 even with improvements to the freeway and bus systems with the corridor. The MIS sought to define a high capacity fixed guideway transit system that would assist in meeting the traffic demands within the corridor and reduce congestion.

Several transit technologies and route alignments within the HDC were analyzed by the MIS. The technologies and alignments were refined using several evaluation criteria in order to select a locally preferred alternative (LPA). The evaluation criteria included costs, ridership forecasts, environmental review, and public input. An advanced review involved the evaluation of four transit technologies:

- Light Rail Transit (LRT)
- Busway
- Express Bus
- Commuter Rail

The CP/EV MIS effort has resulted in the development of the proposed CP/EV LRT line currently planned for implementation in 2006. This LRT alignment is discussed in more detail later in this section.

The technologies analyzed in the CP/EV MIS will also be considered for inclusion in the High Capacity Transit Plan. As such, the research criteria used in the MIS will be studied to determine the appropriateness of using these criteria in the identification of alignments and technologies for the High Capacity Transit Plan.

MAG Fixed Guideway System Study

This study analyzed several transit technologies and potential corridor alignments throughout the MAG region. The cities of Phoenix, Tempe, Mesa, Scottsdale, and Glendale participated in this study effort to enhance transit services within the region. The two other studies, the Central Phoenix/East Valley MIS and the Glendale/North Phoenix MIS, were conducted in conjunction with this study to enhance the transit network in the MAG region.

High travel corridors within the MAG region were identified as part of this study effort. Evaluation of these corridors included gathering information about existing and projected population and employment densities, existing transit ridership, work trip origins and destinations, and corridor automobile congestion. This information was used to develop a set of criteria for evaluating potential technologies and alignments for fixed-guideway transit systems.

Technologies reviewed as a part of this study are similar to those being reviewed for the High Capacity Transit Plan and included commuter rail, light rail, express bus, and automated rail.

Upon completion of this study, several recommendations were made to enhance the transit services provided in the MAG region. Recommendations included the development of a light rail transit (LRT) system, enhancements to express bus services and an expansion of local bus service to provide connections to work destinations and other transit modes. The analysis of transit technologies and system alignments performed in this study will be reviewed during the production of the High Capacity Transit Plan. Recommendations will be considered for inclusion in the plan as appropriate.

Systemwide Transit Planning Study

This study was completed by MAG in 1986 to identify long term transit improvements needed within the MAG region to meet projected population and employment growth through 2005. A major focus of the study was to determine if transit technologies beyond local bus service (i.e. commuter rail, light rail, and express bus) were appropriate given project travel demand and population growth. Potential express transit corridors were identified along with technologies which were determined to be appropriate for implementation within the proposed corridors.

Population, employment, and travel projections for the year 2005 are contained within this study. The projects contained within this study will be compared to the existing conditions now present in the MAG region. The results of this comparison will provide insight into whether or not the travel and transit demand projected in this study has materialized in the MAG region. Transit enhancements proposed by this study will also be identified to determine if any of the recommendations have been implemented, and if so, if these new services meet the current regional transit demand. Recommended transit services that have not been implemented will be reviewed to determine if the proposed technology and alignments are still relevant given existing population and employment densities and travel patterns.

Scottsdale/Tempe North/South Transit Corridor Study

This project is a joint effort between the Cities of Scottsdale and Tempe to identify High Capacity transit services which would link the two cities to the proposed Central Phoenix/East Valley (CP/EV) light rail line. The project study area experiences a large amount of vehicle congestion due the limited number of north-south travel corridors for vehicle traffic. In Tier 1 of this study, several transit technologies were evaluated to develop a short list of potential transit improvements. The transit technologies included heavy rail, light rail transit (LRT), bus rapid transit (BRT), Automated Guideway Transit (AGT) and commuter rail. LRT and BRT systems were selected as the preferred technologies given the level of transit demand, visual aesthetics, available funding, and right-of-way limitations present in the study corridors.

Three separate alignments and their corresponding technologies were selected for evaluation in Tier 2 of the MIS. The first alternative proposes the placement of an LRT alignment along the Scottsdale Road/Rural Road corridor from Indian Bend Road to the CP/EV line. This alternative currently has three branch alignments under study near Downtown Tempe to determine the best possible connection to the CP/EV line. All three alignments would join the CP/EV LRT using a “Y” junction to provide for interlined operation of the two LRT systems. A major consideration in determining the recommended alignment involves limiting the number of rail crossings over the Salt River. Environmental and cost concerns may require that the crossing be located adjacent to the new CP/EV crossing.

The remaining two alternatives involve BRT and express bus services. The BRT alignment is located in the Scottsdale Road/Rural Road corridor as is the LRT line proposed in the first alternative. Two alternative branch alignments exist near downtown Tempe, with the proposed connections to the CP/EV located near Arizona State University. The final alternative proposes express bus service along the Pima Freeway (SR-101) from Indian Bend Road to the proposed CP/EV Price Road station. In this alternative, buses will operate in the High Occupancy Vehicle (HOV) lanes located in the center of the freeway.

Several of the current alignments and all planned future southern extensions of the proposed transit services contained within this study intersect with the Union Pacific (UP) Railroad, creating opportunities for linkages between these services and potential commuter rail service in the UP corridor. The final technology and alignment alternatives recommended by this study will be examined in the High Capacity Transit Plan for possible extensions or deployment elsewhere in the MAG region in areas where commuter rail is not feasible.

A draft of the Tier 2 Final Report was released in October 2001. The Tier 3 review is expected to be completed in 2002 with the selection of a single Locally Preferred Alternative (LPA) project.

Chandler Transit Plan Update and High Capacity Transit MIS

City of Chandler is conducting two transit studies concurrently in order to identify the transit needs of the community over both short-term and long-term periods. Financial plans are part of each study in order to properly identify available funding sources for the recommended improvements.

The Transit Plan Update is studying the short-term transit needs of the City and surrounding unincorporated areas through 2007. The study will identify transit enhancements which are capable of being funded and implemented during the short-term time frame of this study. According the proposed project schedule the financial analysis is scheduled for completion in March 2002. The final report containing the study recommendations is scheduled for completion in April 2002.

The High Capacity Transit Major Investment Study (MIS) is more regional in scope than the Transit Plan Update. This MIS is looking at long-term (2020) transit solutions and studying the creation of transit connections between Chandler and the surrounding cities of Gilbert, Mesa, and Tempe. Several different technologies are being considered as a part of this effort including LRT, Commuter Rail, and BRT.

Three tiers of review and evaluation are included as part of this study. Tier 1 involves a review of all available transit technologies and the transportation corridors available within the study boundary. At the completion of this tier, the number of transit technologies and potential corridors will be reduced to a smaller number for further evaluation. This first tier is expected to be completed in February 2002. Tier 2 will undertake a more detailed analysis of the remaining technologies and corridors and evaluate the appropriateness of each technology based upon rider demand and projected costs. This tier is scheduled for completion in April 2002. The Tier 3 evaluation will look at the final two or three potential alternatives remaining after the Tier 2 analysis. The result of the Tier 3 evaluation will be the recommendation of a Locally Preferred Alternative (LPA) in July 2002. The project Implementation Program will then be completed in August 2002.

The Union Pacific freight rail line travels southeast from central Phoenix through the City of Chandler, making the city a prime candidate for commuter rail service. The results and recommendations of both the Transit Plan Update and the Transit MIS will be examined as part of the High Capacity Transit Plan. Recommendations will be included in the High Capacity Transit Plan as appropriate.

Regional Public Transportation Authority (RPTA) Regional Transit Study

The Regional Transit Study is examining potential enhancements to local bus and dial-a-ride services within the MAG region. The RPTA is taking a comprehensive approach with this study, looking at land use and population projections, future transportation improvements, existing and future travel patterns, and the existing and planned transit network. Both short-term and long-term transit needs will be assessed for this project. Recommended improvements to these services will be incorporated into the Regional Transportation Plan currently under development by MAG.

Fixed route bus and other local transit services are essential parts of the regional transportation network. Effective local services increase the benefit provided by high capacity transit services such as commuter rail and light rail. Without local fixed-route service commuters using high capacity forms of transit would have no connections between transit stations and employment and residential origins and destinations. The recommendations of the Regional Transit Study will be evaluated and compared to the recommendations of the High Capacity Transit Plan during the production of both studies. Linkages between the services planned in the High Capacity Transit Plan and those planned in the Regional Transit Study are essential. The High Capacity Transit Plan will evaluate ways to maximize the linkages between local and high capacity regional services to make the service recommendations in both studies as effective as possible.

The project study process began in January 2002. An overview and evaluation of the current transit network is slated for completion in April 2002. The study alternatives, recommendations, and performance criteria are scheduled for completion in October 2002. December 2002 is the planned completion date for the entire study including the adoption of implementation strategies and an action plan.

Grand Avenue Northwest Corridor Study

This study is looking at different alternatives to reduce traffic congestion along the Grand Avenue Corridor between Loop 101 and Loop 303. Several study efforts have been undertaken for this arterial during the past 20 years. Previous studies have recommended the creation of a freeway or expressway to replace Grand Avenue. This study is focused on improving traffic flow and reducing traffic congestion without the creation of a new freeway or full expressway due to limited amounts of available funding. Strategies for accomplishing these objectives include widening Grand Avenue, grade separating intersections, improving alternative routes to remove and redirect traffic, and reducing conflicts between the parallel rail line and cross traffic.

Rail freight traffic within the study area is of particular concern due to the delays caused by long, slow moving freight trains. An increase in freight traffic is expected within the corridor given the increase in population for the Phoenix metropolitan area. This study is attempting to develop ways for freight rail and vehicle traffic to operate together in a more efficient manner.

Given Grand Avenue's place as a major transportation corridor within the regional transportation network, it will receive extensive review as a potential High Capacity transit corridor. The BNSF railroad line runs parallel to Grand Avenue through the length of the study area. The existence of the BNSF rail corridor increases the options for accommodating High Capacity transit services. As such, the recommendations resulting from the Grand Avenue Northwest Corridor Study will have substantial impact on potential commuter rail operations in this corridor. Enhanced transit services recommended in the High Capacity Transit Plan could be combined with the recommendations of this study to reduce congestion and improve traffic flow in this corridor.

A draft report containing the recommended enhancement alternatives is expected to be released in Spring 2002.

Northwest Area Transportation Study

This study effort will identify multi-modal transportation projects which would reduce traffic congestion within this subregion of the MAG region. The cities involved in this study are:

- El Mirage
- Glendale

- Peoria
- Surprise
- Wickenburg
- Youngtown
- Buckeye

Like most of the Phoenix metropolitan area, this subregion is experiencing rapid amounts of population and traffic growth. The Northwest Area Transportation Study will include a full assessment of the existing and projected socio-economic conditions of the project area, and the effect of these conditions on the transportation needs of the subregion. Public consultations are also a part of this project to determine what the area's residents prefer as possible improvements. All potential transportation improvement options will be considered as a part of this study including new and expanded freeways/roadways, improved bus services, bus rapid transit, rail transit, and improved pedestrian and bicycle transportation.

The Burlington Northern Santa Fe (BNSF) rail line is located within the project study area, creating an opportunity for future commuter rail services in the region. These cities are located on the edge of the metropolitan Phoenix area, and as such, commuters residing in these communities will require long distance transit alternatives in order to reach the employment centers in Phoenix and other central cities. Transit strategies recommended as part of this study will be reviewed for possible incorporation in the High Capacity Transit Plan.

The projected completion date for this study effort is the middle of 2002.

Southwest Area Transportation Study

This study effort will identify multi-modal transportation projects which would reduce traffic congestion within this subregion of the MAG region. The cities involved in this project are:

- Avondale
- Buckeye
- Gila Bend
- Goodyear
- Litchfield Park
- Tolleson

The Southwest Area Transportation Study is similar in scope to the Northwest Area Transportation Study. This study will also evaluate all types of transportation improvements designed to meet the population growth expected in this subregion during the next two decades. Extensive public consultation and review of socio-economic information are included as part of this study.

Two major transportation corridors, the Union Pacific (UP) rail line and Interstate 10 (I-10), are located within the project study area, creating opportunities for future High Capacity transit services in the region. As is the case with cities in the Northwest Area Transportation Study, these cities are located on outer the edge of the metropolitan Phoenix area, and as such, commuters residing in these communities will require long distance transit alternatives in order to reach the employment centers in Phoenix and other central cities. The transit strategies recommended as part of this study will be reviewed for possible incorporation in the High Capacity Transit Plan.

The projected completion date for this study effort is the middle of 2002.

Southeast Maricopa/Northern Pinal County Area Transportation Study

This study is similar to the Northwest and Southwest Area studies. All three studies are being conducted as part of the RTP update. This study includes several cities located in the MAG region including:

- Chandler
- Gilbert
- Mesa
- Queen Creek

Communities from Pinal County are also included. Like the other area studies, this study will be looking and the major transportation needs of this region. Several major transportation corridors exist in this area including US-60, the Union Pacific rail line, and many other smaller highways. Recommendations from this study will be evaluated to help identify potential transit corridors.

The projected completion date for this study effort is the end of 2002.

Park & Ride Site Selection Study

The Park & Ride Site Selection Study was initiated by MAG to identify 20 future park & ride locations near existing and proposed freeways. This study was recently completed in 2001. Express bus services will be implemented to serve these facilities, and provide transit services to employment centers in Phoenix and surrounding cities. Potential park & ride locations were coordinated with proposed HOV lanes to enhance the quality and speed of service provided by the express buses.

The 20 recommended park & ride sites were divided into two groups of ten locations. The first ten locations are proposed for short-term implementation. These facilities are located near existing freeways, many of which already have carpool lanes. The second ten locations have been designated as long-term sites located along proposed future freeway corridors. These facilities will be developed in conjunction with the new freeways to provide service upon completion of the new route.

Park & rides are important infrastructure elements required for the operation of successful transit systems. These facilities have the ability to operate as multi-modal transit centers, providing connections to local bus services, express bus, light rail, and commuter rail. The 20 proposed park & ride locations contained within this study will be evaluated for their appropriateness as future stations for new High Capacity transit services.

East/West Mobility Study

This study is evaluating potential roadway capacity enhancements to major east-west arterial streets in the area bordered by Thunderbird Road/Waddell Road, SR-51, Northern Avenue, and Loop 303. Several capacity enhancing strategies will be evaluated for each major east-west arterial including signal coordination, roadway widening, grade separations, reversible lanes, intersection improvements, and bus turn outs.

The arterial enhancements recommended as a result of this study may provide prime corridors for future deployment of Bus Rapid Transit (BRT). The improved streets may possess wider right-of-ways and advanced signal timing capable of supporting BRT operations.

Summary

Table 1.3-1 summarizes the major ongoing transportation and transit studies in the MAG region.

Table 1.3-1 **Ongoing Transportation and Transit Studies**

Study Name	Lead Agency	Upcoming Project Milestones
Regional Transportation Plan	MAG	Analysis of Alternative Concepts: Summer 2002 Transportation Policies & Strategies: Fall 2002
Scottsdale/Tempe North/South Transit Study	City of Scottsdale City of Tempe	Tier 3 Review: Mid-2002

Study Name	Lead Agency	Upcoming Project Milestones
Transit Plan Update	City of Chandler	Financial Plan: March 2002 Final Report: April 2002
Chandler High Capacity MIS	City of Chandler	Tier 2 Report: April 2002 Tier 3 Report: July 2002 Implementation Program: August 2002
Regional Transit Study	Regional Public Transit Authority	Draft Alternatives & Recommendations: October 2002 Implementation Plan and Project Completion: December 2002
Grand Avenue Northwest Corridor	MAG	Final Report: March-April 2002
Northwest Area Transportation Study	MAG	Study Completion: Summer 2002
Southwest Area Transportation Study	MAG	Study Completion: Summer 2002
Southeast Area Transportation Study	MAG	Study Completion: End of 2002
East-West Mobility Study	MAG	Study Completion: Fall 2002

1.3.3 Transportation & Transit Projects

Central Phoenix/East Valley (CP/EV) Light Rail

The initial segment of this project is a 20.3 mile alignment beginning in the north at the Chris-Town Mall, traveling through Downtown Phoenix and Tempe and into Downtown Mesa. Major activity centers served by this rail system are Downtown Phoenix, Bank One Ballpark/America West Arena, Sky Harbor Airport, Arizona State University, Downtown Tempe, and Downtown Mesa. This initial segment is part of the 39-mile Light Rail Transit (LRT) system planned in the 2001 Long Range Transportation Plan. A list of the major corridors contained in the alignment is included below:

- 19th Street (Phoenix)
- Camelback Road (Phoenix)
- Central Avenue/1st Street (Phoenix)
- Washington Street/Jefferson Street (Phoenix)
- Union Pacific Railroad (Tempe)
- Apache Boulevard (Tempe)
- Main Street (Mesa)

Given the proximity of the LRT alignment to the Union Pacific railroad tracks, there will be opportunities for potential multi-modal stations shared by the LRT system and any proposed commuter rail network. The possible multi-modal stations include the proposed LRT stations near Papago Park Center and Bank One Ballpark/America West Arena. Many of the other High Capacity transit studies currently underway will connect to this rail line including the Phoenix BRT and the final recommended alternative from Scottsdale/Tempe Transit MIS.

The project is in the preliminary engineering stage, which includes the preparation of the Final Environmental Impact Statement (FEIS). Upon completion of this phase, the project will enter final design and the beginning of right-of-way acquisition. Construction is scheduled to begin by 2004, with revenue operations starting in 2006.

Transit alternatives recommended in the High Capacity Transit Plan will be coordinated with the CP/EV LRT line. Potential opportunities exist to connect to the northern terminus at the Chris-Town Mall with BRT or other transit services capable of operating in street rights-of-way. Services from the west could link with the LRT system near the Convention Center/Bank One Ballpark/America West Arena area.

City of Phoenix Bus Rapid Transit

The City of Phoenix is currently planning for the implementation of five Bus Rapid Transit (BRT) routes providing service to Downtown Phoenix. The service will be operating initially during peak periods in the morning (5:00 – 9:00 a.m.) and afternoon (3:00 – 7:00 p.m.) with directional service to downtown in morning and returning to the park & rides in the evening.

Four of the routes will be operated as express bus lines utilizing the HOV lanes on area freeways. The freeways proposed to include service are the Black Canyon Freeway (I-17) north, Squaw Peak Freeway (SR-51) north, and the Papago/Maricopa Freeway (I-10) both west and east. Park and ride stops are proposed to be located at following locations:

- I-17 North: Deer Valley Park & Ride, Metrocenter Transit Center
- SR-51 North: Dreamy Draw Park & Ride and Bell Road
- I-10 West: 79th Avenue Park & Ride, Desert Sky Transit Center
- I-10 East: Ahwatukee North and South Park & Rides

The fifth BRT route will operate in Downtown Phoenix along Central Avenue between Camelback Road and Baseline Road.

The project is still in a planning phase. Additional work is needed to finalize all station locations, park & ride locations, vehicle size and design, and the final BRT Operating Plan. This work will continue during 2002, with network operation on schedule for 2003.

1.4 High Capacity Transit Characteristics

There are several proven High Capacity transit technologies currently in operation throughout North America. Each technology has inherent advantages and limitations. The key to realizing the full benefit provided by various transit technologies is ensuring that the technology implemented is the most cost-effective solution and it matches the transportation demand generated in its proposed service area.

1.4.1 Role of Transit Services

Each type of transit service from commuter rail to fixed-route bus to dial-a-ride service fulfills a defined role within the regional transit network. The type of transit services required in a region should not be determined until specific service corridors and alignments are selected. Once the alignments have been selected, the transit demand of the surrounding area can be properly determined and the appropriate transit service selected to meet the projected demand. Transit services can be classified into three categories:

- Regional connectors
- Primary trunks
- Local feeders or branch services

The services that fall into these categories fulfill different roles in the regional transit network. A short description of the role of each service category and the transit technologies contained in each category is provided below.

Regional Connectors

Transit services classified in this category provide high-speed, long-distance service within the metropolitan region. Operational speeds typically exceed 20 m.p.h. with stations spaced far apart. These services are designed to carry large numbers of passengers and serve a wide geographic area. Commuter rail and express bus services are most commonly categorized as regional connectors. The proposed Phoenix BRT system providing connections between Downtown Phoenix and outlying park and rides would be classified as a regional connector for the MAG region.

Primary Trunks

Transit services in this category typically provide frequent service over medium to long distances at slightly lower speeds than regional connectors. These services are designed to carry a large number of passengers, in some cases more than regional connectors. However, the distance of traveled for many of these trips will be shorter in length than the average trip taken on a regional connector. Several transit services are capable of operating as primary trunks within a regional transit network including heavy rail, light rail, bus rapid transit, and fixed-route bus services. Heavy rail and light rail systems can also operate as regional connectors depending upon the operational speed of the system and the number of stops along the alignment.

Local Feeders and Branch Services

Services within this category provide connections between regional connectors, primary trunks, and transit centers to employment and residential destinations. The larger transit services described before are usually unable to provide the local and sometimes door-to-door service provided by these local feeders. Fixed-route bus services and small transit center feeder buses commonly provide these services.

Relation to High Capacity Transit Plan

The main transit technologies which will be evaluated in the High Capacity Transit Plan are those classified as regional connectors and primary trunks. These types of technologies are capable of providing the medium and long-distance high capacity transit service required for this study. The transit technologies in each category will be evaluated against the transit needs of each corridor selected for inclusion in the High Capacity Transit Plan. Appropriate technologies will then be selected and recommended for implementation.

1.4.2 Technology Comparison

The characteristics of five High Capacity transit technologies will be compared in this section. Representative applications of the technology in North America will also be discussed. The technologies under consideration include:

- Commuter Rail
- Heavy Rail
- Light Rail
- Automated Guideway Transit

- Bus Rapid Transit

Additional analysis of other technologies is also provided. Diesel Multiple Unit (DMU) cars, CIVIS Rapid Transit, and Maglev technologies will be discussed and current North American transit agencies studying the potential for implementing these services will be identified.

Table 1.4-1 **Summary of Transit Service Roles**

Transit Technology	Regional Connector	Primary Trunk	Branch Service
Commuter Rail	☑		
Heavy Rail	☑	☑	
Light Rail	☑	☑	☑
Automated Guideway Transit		☑	☑
Bus Rapid Transit	☑	☑	☑

In the process of recommending High Capacity transit technologies for specific corridors in the MAG region, it is essential that the proposed technologies fulfill the transit needs of the corridor and that the technology compliments existing transit services operating within the corridor. A detailed set of evaluation criteria must be used in order to properly study each technology and recommend the appropriate technology for each corridor. Evaluation criteria include:

- Technology – Has the technology been in revenue operations for a long time?
- Performance – What is operational speed of the technology? What is the passenger carrying capacity?
- Environmental Impacts – Will the technology cause severe environmental impacts or will it benefit the environment by reducing vehicular traffic?
- Capital Cost – Are large amounts of new right-of-way required to implement the system? Is the system infrastructure intensive, requiring elevated structures or subterranean alignments? Are vehicles or propulsion systems expensive?

1.4.3 Commuter Rail

Commuter Rail service is typically provided in existing freight railroad corridors and shares the rail lines with freight rail and in some locations, Amtrak passenger services. This technology commonly consists of a diesel-powered locomotive powering a series of passenger cars along the rail line. In some areas, commuter rail systems use electric locomotives or self-propelled diesel or electric cars. Commuter rail trains are capable of high-speeds (up to 90 m.p.h.), making their operation appropriate for long-distance trips. Commuter rail systems in operation in the United States are typically used to provide transit services from outlying suburbs to urban centers and downtowns. Several metropolitan areas in the United States have extensive, well-developed commuter rail systems including New York, Boston, Chicago, San Francisco, and Philadelphia. In addition to these established commuter rail systems, new commuter rail systems have been implemented during the past two decades in Los Angeles, Dallas, Seattle, Miami, San Diego, and San Jose/Stockton, California. In total, 18 commuter rail systems are operational in the United States.

Commuter rail has the ability to provide service during peak commute times and throughout the day. However, mid-day service is typically only implemented in high-density urban areas capable of supporting off-peak operations. Most of the commuter rail systems established during the past decade operate only during peak commuting periods. These newer systems also usually have directional commuting patterns, to the downtown center in the morning and returning to the suburbs in the afternoon. Special service operations are possible including one-time service to sporting and cultural events located at venues along the rail route.

Capital Costs

Capital costs for establishing a commuter rail system can vary dramatically depending upon the existence and quality of rail right-of-way and facilities. The cost of implementing commuter rail operations along an existing freight rail line can range from $2 million to $25 million per mile, depending upon the condition of the rail line, number of stations, and the complexity of stations. Costs can increase dramatically if expensive double-tracking, grade separations, or large amounts of new right-of-way are required.

Technology Characteristics and Relationship to Other Transit Services

Commuter rail has the ability to utilize existing rail rights of way and tracks, potentially minimizing the capital costs of implementing service. Rather than requiring the construction of new rail lines and acquisition of right-of-way, commuter rail service can be implemented after existing freight lines are upgraded to accommodate the desired service speed of the trains. Stations will be required along the rail lines to facilitate transfers between the commuter rail system and other transit systems. The stations can be built as solely commuter rail stations consisting of a parking lot, station platform and shelter, or they can be built as full multi-modal facilities including park-and-ride lots, local and rapid bus service stops, and connections to heavy and light rail systems. Commuter rail service does not need to be grade-separated from cross-traffic arterial streets. However, grade separation would be preferable in selected locations to reduce possible delays to vehicular traffic in heavily traveled corridors.

Commuter rail operates as a regional connector within the regional transit system. These types of services usually also draw their ridership base from a large geographic area, permitting stations to be located further apart. Regional connectors link to primary trunks and local circulator transit services at stations to allow riders to transfer to these smaller transit services and reach employment and residential destinations.

Operational hours can vary for commuter rail depending upon demand. Newer commuter rail systems, such as those now operating in Dallas and Seattle operate only during peak periods when commuter traffic levels are high. Fully mature systems in dense urban areas such as Chicago and New York are in operation up to 18 hours a day. Intermediate systems like that of Los Angeles will have frequent service during peak periods and much lower service during off-peak times.

Environmental Considerations

The use of diesel locomotives can have a negative impact upon air quality. However, the reduction in automobile vehicle trips that result from the implementation of commuter rail operations can offset the pollution impact of the diesel emissions.

Residential areas located near the rail corridors may be impacted by the increased number of trains operating in the corridor. Noise impacts can be minimized by grade separating nearby street crossings, reducing the need to use train horns. Limitations on speed and noise can also be imposed over short distances near residential development.

Commuter rail operations can also impact street traffic because of the increased number of trains passing through grade crossings. However, the impact of one single commuter rail train on particular grade crossing is much less than that of a slower-moving and much longer freight train. Most commuter rail trains can clear a crossing quickly, causing on average about 20 to 40 seconds of preemption versus 150 to 200 seconds for a freight train. A high number of trains serving a particular corridor may have a negative impact due to the crossing gates being activated more often and causing multiple delays. This situation usually only occurs when major commuter and freight rail operations are taking place in the same corridor concurrently and rail service is provided in both directions.

Stations

The stations provided for commuter rail operations can vary in size and amenities depending upon the level of passenger demand and the number of available connections to other transit services. Stations are typically located two to ten miles apart. The basic commuter station configuration consists of a station platform, parking for train riders, a shelter or small station building for rider comfort, and a ticket counter or automated ticket dispensers. From this basic setup, the stations can be expanded and enhanced to provide connections to heavy or light rail systems present in the area. Bus bays can be added to provide connections to local and rapid bus services. Additional rider amenities can be provided in the form of restrooms, lockers, cafes, eateries, lounges, and retail stores. Larger stations have the ability to be the center point of mixed-use development which includes retail, office, and possibly residential uses.

Most commuter rail stations provide parking for riders on site. Stations with larger amounts of available land have the capability of serving dual roles as commuter rail stations and park & ride facilities. Existing park & rides located near or adjacent to new commuter rail corridors can assist in the reduction of station development costs.

Vehicles

Most commuter rail systems currently operating in the United States utilize diesel locomotives and coaches for transporting passengers along their routes. The Long Island Rail Road, the nation’s largest commuter rail operator, operates electric powered trains in major corridors as do other systems in the Philadelphia and New York regions. Diesel locomotives are a proven technology which has been in operation for decades. Vehicles are available from a number of manufactures.

Passenger cars vary in type from operator to operator. Most of the newer commuter rail operators have purchased bi-level passengers cars for their operations. These vehicles permit a larger number of passengers to be carried per train when compared to single-level passenger cars. Bi-level cars typically carry 150 to 200 passengers, while single-level cars carry about 100 to 115 passengers. New modern passenger cars can also be effective marketing tools, containing rider amenities designed to attract new riders to the system. There are several manufactures constructing passenger vehicles which are appropriate for commuter rail operations. This allows operators to choose from a variety of manufactures to select a vehicle which meets their operational and cost criteria.

Maintenance and Storage Facilities (MSFs)

Commuter rail systems need facilities for storage and repair of vehicles used in the operation of the system. Typically, these facilities are located near either the outer or inner ends of a route to facilitate easier start-up of operations each day. The size of commuter rail system dictates the size of the MSF. Larger operations will involve more vehicles, which require a greater amount of land be set aside for storage and maintenance. Larger commuter rail networks may maintain several MSFs to reduce the time and cost of positioning trains for service each day and because an inadequate amount of land may be available for construction of a single, larger MSF.

1.4.4 Heavy Rail

Heavy Rail is a form of high capacity transit most effective in dense urban areas capable of supplying the system with a high number of riders. Examples are the New York subway and the Bay Area Rapid Transit (BART) system in San Francisco. This type of rail transit is also known as metro rail, subway, or rail rapid transit. The technology is typified by trains running in a separated right of way which can be elevated, subterranean, or at ground level. Power is supplied to the cars through an electrified third rail running parallel to the tracks on systems in North America. Overhead electric lines are used on some systems in Europe. The third rail necessitates that separate rights-of-way with no grade crossings be provided for these trains.

Several large cities in the United States operate extensive heavy rail transit networks including Chicago, New York, and Boston. These systems were implemented early in the 20th Century to serve growing urban populations. During the past 30 years, heavy rail systems have been built in San Francisco (BART), Washington D.C., Atlanta, and Los Angeles (Red Line). A characteristic separating heavy rail operations from commuter rail operations is the ability of heavy rail to provide frequent service in peak periods and carry large amounts of passengers throughout the day. Peak period service can be provided with two minute headways, compared to a typical maximum of 15 minutes for commuter rail.

Heavy rail has the ability to be used to provide transit service within the urban core or between a major city and its suburbs. The typical maximum vehicle speed is 40 to 80 m.p.h. Stations are typically located closer together than commuter rail stations (0.5 to 2 miles) since heavy rail trains are capable of faster acceleration and deceleration and provide more short-range service.

Capital Costs

The necessary grade separation increases the capital cost of implementing a heavy rail system. Entirely elevated or subterranean systems have many more capital expenses than at-grade systems. The capital cost of constructing an elevated system can range from $50 million to $100 million per mile. Subterranean alignments can more than double this per mile cost to $200 million or more. These transit systems need to have high ridership levels in order to be cost effective when compared to other high capacity transit technologies.

Technology Characteristics and Relationship to Other Transit Services

Heavy rail tracks can be elevated, subterranean or both. Separation from other forms of transportation is required due to the presence of an electrified third rail, which provides power to the trains. Systems elevated above ground require a right-of-way corridor wide enough to provide operational space for a minimum of two tracks and their associated support structures. Rail lines can be constructed above existing streets or highways. Other placement options include freeway medians as is the case with some lines in Chicago. Railway rights-of-way have also been used such as on heavy rail lines in Cleveland and Boston.

Heavy rail can operate as both a regional connector transporting large amounts of passengers over long distances, and also as a primary trunk delivering passengers to transit centers and local feeder services or directly to places of employment. The catchment area of stations can vary from ¼ mile to two miles or more depending upon the proximity of stations and density of surrounding land uses. When operating as a trunk service, heavy rail stations can provide connections to local bus and shuttle services, as well as light rail systems. Service can be provided 24 hours a day. Most lines provide service for 16 to 20 hours each day.

Environmental Considerations

Environmental impacts can be created during the construction of heavy rail systems. The construction of a fully elevated system will impact the visual aesthetics of neighborhoods through which the rail line passes. Subterranean systems require the removal of large amounts of earth from below existing development. This action can weaken fountains of buildings and cause settling of the surface above the alignment.

The impact of heavy rail systems upon air quality vary depending upon the source of the electricity used to power the system. If non-fossil fuel burning electricity sources are used, impacts to air quality will be negligible.

Stations

Heavy rail stations are located on the same grade as the rail line with access provided to ground level. Station design can range from a simple single level platform for waiting passengers to a multi-level station servicing multiple rail lines with passenger amenities such as food and retail shops, restrooms, and lounges. Stairs, escalators, and elevators are required to facilitate passenger travel between the station and ground level. Payment systems are usually automated with fare payment required prior to entering the train boarding area. Many stations utilize a barrier system which prevents entrance into the station boarding area until the passenger fare has been paid. Several subway and metro rail systems use fare or "smart" cards for payment. These cards can be credited with money at automated machines and used for the payment of multiple fares. The cards can also be "recharged" and reused indefinitely or until a predefined expiration date is reached.

Heavy rail stations are located within short distances of other stations (less than 1 mile), so they do not always require on-site parking since most passengers have the ability to walk or use local transit services to reach the station. Stations may contain bus bays and transfer areas at street level, allowing riders to more efficiently transfer between transit services.

Vehicles

The vehicles used in heavy rail operations do not have separate power cars or locomotives as is the case with commuter rail trains; all cars are powered. The lead car in each train contains a compartment in the front of the vehicle for the driver to operate the train. This car also contains seating areas for passengers. Most metro rail system cars must be attached in "married pairs" in order for the train to operate. These married pairs can be semi-permanently attached to each other and are usually dependent upon each other for the distribution of power received from the electrified third rail. Some metro rail systems are capable of operating with single cars such as the Bay Area Rapid Transit (BART) system in San Francisco. Typical heavy rail train consists include two to eight cars. Average cars are capable of carrying a maximum of 200 passengers.

Maintenance and Storage Facilities (MSFs)

MSF requirements for heavy rail can be greater than those of commuter rail due to the increased number of vehicles required to provide frequent service. Land requirements to store and maintain the vehicles could be substantial depending upon the amount of service provided. The facilities need to be sited near the rail alignments to allow vehicles to enter and leave service conveniently.

1.4.5 Light Rail

Light Rail Transit (LRT) is a third form of rail transit in extensive use in metropolitan areas throughout the United States. LRT systems are different from heavy rail systems in that LRT trains are powered by overhead electric wires instead of an electrified third rail. This configuration allows the trains to operate within multiple rights-of-way including in streets with mixed-flow vehicle traffic in reserved lanes or fully grade separated in an elevated structure.

LRT vehicles can consist of a single car or multiple cars linked together. At-grade trains typically operate no faster than the posted speed limit on arterial streets. Higher speeds (up to 70 m.p.h.) are possible for grade-separated systems. LRT differs from commuter rail in that stations are not usually spaced as far apart. Stations can be built as close as 300 to 400 yards apart in dense areas, and can be separated by one to two miles in other areas.

Several cities have implemented new light rail systems during the past decade including Los Angeles, Dallas, St. Louis, and Portland, OR.

Capital Costs

It is possible for the capital cost of implementing light rail to vary dramatically depending upon whether or not the system is elevated or located at grade. Costs range from $25 million per mile for at grade systems which require minimal amounts of street widening and right-of-way acquisition to a top end of $75 million per mile for fully elevated systems requiring support structures and elevated stations.

LRT systems which run within street rights-of-way may necessitate street widening and intersection modifications. Costs can be reduced if other rights-of-way are used such as rail rights-of-way or if the light rail tracks share a travel lane with automobiles, reducing the need for additional right-of-way.

Technology Characteristics and Relationship to Other Transit Services

LRT is the most flexible form of rail transit, able to operate in several different types of corridors. The two different basic configurations possible for an LRT alignment are elevated and at-grade. It is also possible for an LRT system to have both elevated and at-grade sections. At-grade systems have additional flexibility given their ability to operate in rail corridors and within arterial street alignments either with mixed-flow traffic or separated by a fixed barrier.

Service on light rail systems can be provided 24 hours a day. Most services currently in operation in the United States operate 16 to 20 hours per day. Service frequency during peak periods can be as often as every five minutes. A maximum headway of 20 minutes in off-peak periods is recommended to maintain convenient service for riders.

LRT systems are capable of fulfilling all three major roles within the regional transit network. They can operate as regional connectors transporting a large number of riders from wide catchment areas over large distances, or as primary trunks providing frequent service to many passengers. LRT systems can also operate as branch services providing connections for riders from other transit systems including heavy rail and commuter rail to employment centers and residential areas.

Environmental Considerations

Similar to the impact caused by heavy rail transit systems, the environmental impact to air quality caused by electric LRT systems is minimal. Increased electricity use may cause slight impacts depending upon the fuel used to generate the electricity. Other impacts include those to visual aesthetics. At grade systems have a minimal effect as a result of the presence of overhead wires. Elevated systems will have a greater effect due to the elevated structures which may disrupt views.

Stations

Light Rail station design can be as flexible as the light rail technology. At-grade stations can located adjacent to the roadway and rail line, either as a stand-alone structure and station or as a shelter and ticket area sharing pedestrian facilities with the street sidewalk. Ticket purchasing on many of the newer LRT systems is typically performed at automated vending machines with permanent or random ticket checks by transit staff. Stations can be located as close as ¼ mile apart or as far away as three to five miles depending upon the density of surrounding land use and passenger demand.

Vehicles

LRT trains consist of one to three or more vehicles depending upon vehicle capacity and passenger demand. The lead vehicle contains a small compartment for use by the train operator. Passenger cars carry anywhere between 50 to 150 passengers each. Many new vehicles contain additional space for the storage of bicycles, wheel chairs, and strollers.

Maintenance and Storage Facilities (MSFs)

The requirements for storage and maintenance of light rail vehicles can be less than those of heavy rail systems because while light rail operations can have the same frequency of service, there are fewer vehicles in light rail trains than on heavy rail trains. MSFs need to be located near the rail line to facilitate easy transfers in and out of service for rail vehicles.

1.4.6 Automated Guideway Transit (AGT)

Automated Guideway Transit is distinguished from the other forms of High Capacity transit systems discussed before in that the system does not have a driver operating the vehicle. Three cities, Vancouver, Toronto, and Miami have implemented successful AGT systems as part of their regional transit network. The largest system is the 18 mile SkyTrain located in Vancouver; a second line is currently under construction with the first two stations open. A monorail form of AGT is being designed in Las Vegas.

Additional forms of AGT systems exist including people movers, monorails, and personal rapid transit (PRT) vehicles. These systems are operated on a small scale within office complexes, theme parks, airports, and universities. Prime examples of this form of the technologies are located at O'Hare International Airport in Chicago and Downtown Jacksonville, Florida. The maximum speed of these systems is approximately 30 m.p.h. As such, they are not appropriate for High Capacity long-distance service. Service distances of 3 to 5 miles are more typical.

Capital Costs

The capital cost of constructing an AGT system ranges from $50 to $100 million per mile. This can be higher than the usual cost of an elevated light rail system. The higher cost is due in part to the limited number of manufacturers of AGT technology, reducing the amount of price competition in the marketplace. A second factor is the relatively recent implementation of the technology, meaning that sufficient time has not elapsed to allow for economies of scale to result in cost reductions for vehicles and system parts.

Technology Characteristics and Relationship to Other Transit Services

While large, regional AGT systems are not as widely implemented as light rail and heavy rail systems, the technology has been in operation for several years, increasing system reliability. Instead of utilizing a driver located in the lead vehicle, AGT trains are operated remotely by computer. These remote operations are supervised by technicians who have overall control over the operation of the system and individual trains. The AGT systems operated in Vancouver, Detroit, and Toronto use conventional steel rails to guide the vehicles. Steerable axles have been added to reduce wear and noise in curves.

The service headway for AGT trains during peak periods can range from 2 minutes upward. Service frequencies can be increased for passenger surges caused by special events such as a concert or sporting event. The automated service allows for more frequent service and allows vehicles to be efficiently added and removed from service as needed. Off peak service is provided frequently as there are no marginal labor factor costs.

The absence of a vehicle operator necessitates that AGT systems be fully grade separated from other forms of traffic. AGT systems are usually elevated above ground, and can operate on an elevated structure located within the right-of-way of an existing arterial street or a railway right-of-way.

AGT systems have the ability to fulfill dual roles within the regional transit network. The system can operate as primary trunk service providing frequent high capacity transit service. The 18-mile SkyTrain performs this function for commuters in metropolitan Vancouver. A second operational choice is for local transit dispersion, providing service directly to office buildings and activity centers similar to Miami's people mover.

Two other major AGT technologies mentioned earlier are monorails and PRT vehicles. Monorails are distinguished from other types of AGT systems because the rail vehicles operate while riding on or suspended from a single rail, beam, or tube. The most well-known examples of this technology are the monorail systems operating at Disneyland and Disney World and the 1.2 mile system in Seattle linking the downtown with Seattle Center. These systems are known as supported monorails, which operate with passenger compartments located above the rail guideway. A second monorail configuration is a suspended monorail where the passenger compartment is located below or beside the support guideway. Systems of this type are in operation in Germany and Japan.

PRT systems involve small vehicles capable of carrying anywhere from 2 to 30 passengers. These systems are envisioned to connect multiple destinations or buildings with a network of elevated guideways. The vehicles used in this service are smaller than typical rail transit vehicles to provide a degree of privacy and personal space for riders. Two operational variations are possible with this technology. Passengers can either request vehicles on demand or a circulator service with frequent headways can be implemented. In order to provide sufficient service, a large number of vehicles would be required for PRT operations.

One example of this in operation is the people mover for the University of West Virginia. This system has been in operation in 1975 and provides service throughout the university and into nearby Morgantown.

Environmental Considerations

AGT vehicles have no exhaust emissions, making their impact on air quality similar to the impacts caused by heavy and light rail systems. The only source of emissions would be those released by the power source supplying power to the vehicles. Visual impacts would occur due to the presence of the elevated tracks and support columns.

Stations

The design of AGT stations can be very similar to those of elevated heavy and light rail stations. Amenities can include automated ticket dispensers, restrooms, and refreshments. The stations also have the capability to provide connections to other transit systems. Like LRT stations, AGT stations can be located near residential and commercial areas to create mixed-use developments.

Stations are usually located ½ to 1 mile apart depending upon density and passenger demand. The stations are elevated, meaning stairs, escalators, and elevators are required to facilitate passenger travel between the station and ground level. Parking is not required at most stations since AGT stations are spaced closely together in order to serve ¼ to ½ mile areas, allowing riders to walk or use bus shuttle services to reach the station.

Vehicles

Propulsion of AGT vehicles used in Vancouver and Toronto is achieved using linear induction motors. These motors are powered using an AC power supply. This power supply is used to create magnetic fields which generate energy, pulling the vehicles forward. This technology therefore has no moving parts and low maintenance costs.

AGT passenger vehicles of the systems in operation are smaller than the majority of light rail vehicles currently in operation. The average AGT vehicle carries about 75 passengers. Smaller circulator vehicles in airports and downtowns may have a maximum capacity of only 10 passengers. These figures are low when compared to a maximum of 150 passengers for light rail vehicles. Two or four vehicles are linked together to form one AGT train.

Maintenance and Storage Facilities (MSFs)

Maintenance and storage requirements for AGT systems can be more complicated than those required for heavy and light rail systems. The MSF size is similar to that required for a light rail system providing the same service frequency and service capacity. Maintenance of the vehicles can be more complicated and time consuming as a result of the advanced technology used by AGT. As with other forms of rail transit, MSFs for AGT systems should be located close to the rail alignment to facilitate easy transfers of vehicles in and out of service.

1.4.7 Bus Rapid Transit (BRT)

Bus Rapid Transit (BRT), also know as Express Bus or Rapid Bus, is gaining more acceptance and appeal as an effective form of High Capacity transit in the United States. This technology is extremely flexible, able to operate in regular vehicle lanes in streets and freeways or in separate rights-of-way.

BRT is distinguished from regular bus services by several upgrades to service operations and passenger amenities. Many BRT operators implement service with new vehicles equipped with advanced technology. The new BRT systems are marketed to potential riders as faster alternatives to standard bus service. Vehicles are given futuristic or distinctive exterior treatments and branded with terms like “rapid” or “express”. Improved passenger and station amenities include low floor buses, advanced or automated fare collection, on-board passenger information systems, real-time bus arrival information, and full stations featuring the same amenities as many LRT stations.

BRT shares some operational similarities with LRT, but with usually much lower capital costs and greater flexibility to expand or modify services to meet changing demand. BRT is operational in several locations in the United States and Canada including Los Angeles, Vancouver, Pittsburgh, Ottawa, and Washington D.C.

The BRT systems in Ottawa and Pittsburgh operate in separate rights-of-way called busways or transitways. These rights-of-way typically parallel existing highway or rail corridors and allow for the BRT vehicles to provide rapid service. Los Angeles and Washington BRT systems make extensive use of the regional freeway networks and high occupancy vehicle (HOV) lanes to provide express bus service from suburbs to downtown. Vancouver and Los Angeles have implemented on-street BRT services using routes with few stops, exclusive bus lanes, and distinctive vehicles.

Capital Costs

The cost of constructing and implementing a BRT or express bus service can vary dramatically depending upon the infrastructure implemented for the operation of the system. The express bus services operating in existing high-occupancy vehicle (HOV) lanes have average capital costs ranging from $0.5 million to $6 million per mile. Major corridor improvements are not necessarily required to deploy service. However, costs can increase if HOV lanes need to be constructed for new service or if new park and rides and HOV on and off-ramps are needed.

BRT systems operating in mixed-flow travel lanes on arterial streets average $0.5 million to $2 million per mile. Stations and new vehicles are the major capital costs associated with this service. More complex stations and advanced vehicles will have higher costs. Signal priority systems can also increase costs, but will result in faster travel times. BRT alignments with exclusive travel lanes or in separate rights-of-way have the highest capital costs as a result of higher infrastructure costs and right-of-way needs. Average costs range from $8 million to $14 million per mile.

Technology Characteristics and Relationship to Other Transit Services

BRT has the ability to be implemented in a variety of ways depending upon the project budget, available right-of-way, passenger demand, and traffic congestion levels. The most common implementations of the service are on arterial streets operating with mixed flow traffic or in exclusive bus lanes.

There are four basic configurations for BRT operations:

- Express Bus – Utilizes freeway corridors and HOV lanes and operates with mixed-flow automobile traffic.
- BRT "Lite" – Operates on arterial streets with mixed-flow vehicle traffic.

- BRT Bus Lane – Involves the construction of exclusive bus lanes located along the right curb or within the center median of an arterial street.

- BRT Busway – A separate right-of-way provided for the exclusive use of buses.

Table 1.4-2 **Summary of Bus Rapid Transit Service Roles**

Transit Technology	Regional Connector	Primary Trunk	Branch Service
Express Bus	☑		
BRT "Lite"		☑	☑
BRT Bus Lane		☑	☑
BRT Busway	☑	☑	

BRT operations are variable depending upon the transit demand within the region. Express bus service in freeway corridors is typically utilized by commuters traveling long distances between residential areas the places of employment. As such, express bus services are typically directional, to the urban core in the morning and returning to the suburbs in the afternoon and evening. Service is provided only during the peak period on weekdays. Headways range from 15 to 60 minutes depending upon demand. The maximum system speed is 55 to 65 m.p.h. depending upon the freeway speed limit. Average operational speed varies depending upon traffic conditions.

On-street BRT Lite systems can provide service during peak periods, off-peak periods, and weekends if demand is warranted. Headways during peak periods can be as frequent as two minutes. Off-peak headways usually range from 10 to 15 minutes. This configuration can serve short, medium, and long range trips similar to LRT systems. Operational speed for BRT Lite will be slightly less since the buses must operate will mixed flow vehicle traffic, which may cause delays.

Bus lanes provide bus services in exclusive lanes within the arterial street right-of-way. These lanes can be located along the right curb or in the center median. Operation in the curb lane usually involves the designation of an exclusive lane using a distinctive paint scheme. Mixed flow traffic in the form of right-hand turn vehicles, bicycles, and in some cases carpools may be permitted to share this lane with bus traffic. Center median bus lanes are usually separate from mixed flow traffic by a low barrier or curb. This orientation may require additional right-of-way to provide sufficient space for stations. Limitations on left-turn lanes are also required to reduce safety risks.

Busways located in separate rights-of-way will have operational advantages over BRT Lite systems and bus lanes. A busway can be located within existing highway or rail rights-of-way or in a newly created right-of-way. The busway is separated from other forms of traffic and is designed for exclusive use by buses. Bus operations within the busway can vary from express bus service with no stops to BRT service with limited stops to local bus service making several stops within the corridor. Operational speeds for BRT service within a busway is similar to LRT systems, with a maximum speed of 40 to 50 m.p.h. Average speed including stops is usually about 20 m.p.h.

Adding to the flexibility of BRT services, BRT vehicles are capable of operating in all four service configurations will no vehicle enhancements or adjustments required. A single BRT alignment has the capability of containing all four service configurations to provide a variety of services depending upon population densities and service demands.

Several BRT studies are exploring the possibility of implementing traffic signal priority systems to make on-street BRT operations faster and more efficient. These systems can make BRT operations similar to LRT operations in terms of operational speeds and passenger capacity.

BRT has the capability to be implemented as an interim high capacity transit service prior to the construction and deployment of other services such as LRT and AGT, which typically require greater amounts of capital investment and, in some cases, higher ridership levels to be cost-effective. Due to its lower capital costs and its ability to operate in a variety of corridors, BRT can be implemented in a selected corridor until construction of other transit services is complete or population density and ridership demand increase to levels which require greater passenger carrying capacity. BRT has the ability to maintain the same operational characteristics as an LRT system. Frequent service, articulated buses, separate rights-of-way, and traffic signal priority systems can increase the operational speed and efficiency of BRT to a level equal to or surpassing LRT.

Examples of BRT as an interim service can be found in the MAG region and in other metropolitan regions in the United States. The proposed Phoenix BRT line along Central Avenue in downtown Phoenix will be operating on an interim basis until the deployment of the CP/EV LRT line in 2006. The operation of this BRT service in the Central Avenue corridor prior to the deployment of LRT service will allow the BRT system to meet the current demand for high-capacity transit and build transit ridership within the corridor. Other examples include the placement of BRT in the

Dulles Corridor near Washington D.C. and planning efforts currently underway in Nashville, Tennessee.

The CIVIS Rapid Transit system is an advanced variation of Bus Rapid Transit. The CIVIS vehicles are similar to buses used for BRT operations. However, these vehicles are guided automatically by an optical guidance system rather than a bus operator. This guidance system allows the CIVIS vehicles to travel within a narrow corridor, reducing the need for additional right-of-way required to construct a busway along an arterial street. Several cities in the United States are examining the potential of implementing these vehicles into revenue service. Las Vegas is planning for the implementation of CIVIS system in 2003. The vehicles will operate in a busway located along the right curb lane of arterial streets. Other cities exploring the possibility of implementing CIVIS systems include Charlotte, NC and Eugene, OR.

Given the large number of arterial streets traversing the region, this technology could be a viable alternative for the Maricopa area. With its ability to operate within arterial street rights-of-way CIVIS vehicles could find a place within the Maricopa transit network. Appropriate arterial street corridors will be examined for the potential implementation of this technology.

Environmental Considerations

Air quality impacts caused by BRT and express bus systems are dependent upon the type of fuel used to power the bus. Diesel buses will have a much greater impact on air quality than liquid natural gas (LNG) buses. Several urban transit providers are deploying LNG buses in an effort to reduce emissions and improve air quality. Visual impacts resulting from BRT operation are minimal since no elevated structures are required for the operation of a BRT alignment. BRT service may disturb vehicle traffic in a street corridor if lanes are taken away to provide service. However, this impact can be reduced as result of increased transit ridership in the corridor. Express bus services cause minimal impacts since operations are conducted in existing freeway corridors.

Stations

The location and complexity of BRT stations will depend upon what type of BRT operations are implemented. On-street BRT services can have stations with few amenities beyond benches and a shelter. Complex stations can be very similar to light rail stations with real-time vehicle arrival information, automated ticket machines, and food and retail vendors. Parking is not usually required since BRT stations are placed to attract riders within a 1 mile radius, permitting some riders to walk to stations.

Express bus services operating in freeway corridors can utilize park and ride facilities as stations. The distance between stations for express bus services are much greater than those for on-street BRT. Distances of 5 to 10 miles between stations are more typical, making the operation of express bus more similar to commuter rail than LRT. Stations can also be implemented near office complexes, colleges, and shopping centers. The Ottawa busway has placed stations near existing shopping and employment centers.

Another example of the flexibility of express and BRT service is reflected in a design implemented by the Los Angeles County Metropolitan Transportation Authority (MTA) which created a transitway in the center of the Harbor Freeway (I-110) between Downtown Los Angeles and Carson, CA. Express buses in this corridor operate in high occupancy vehicles lanes with automobile traffic. Stops have been built in the freeway median near street overpasses, pedestrian overpasses, and where the transitway meets MTA Green Line LRT alignment. This configuration allows for the rapid transit of high numbers of passengers to Downtown Los Angeles with lower capital costs than an LRT alignment.

Vehicles

BRT vehicles can consist of a standard 40-foot bus or articulated buses ranging from 60 to 80 feet in length depending upon passenger demand. Express bus services operating in freeway corridors typically use 40 or 60-foot buses. Smaller, 30-foot buses may be used for express bus service until system maturity is achieved and ridership levels increase.

Low floor buses are used for BRT operations to facilitate faster loading and unloading of passengers. This allows for short station dwell times and can result in higher system speeds.

Most buses in operation in North America use either diesel fuel or LNG for power. Future advances in technology may make electric buses more commonplace, but for now the other two technologies are preferred by most transit operators for heavy service.

Maintenance and Storage Facilities (MSFs)

BRT systems have the ability to utilize the existing MSFs operated by transit providers for local bus services, giving BRT a distinctive cost advantage over the rail technologies studied earlier in this report. The ability to co-locate with existing facilities can reduce the capital costs associated with the acquisition of land for the MSF and construction of the facility. Additional small storage facilities may be desired to store vehicles closer to the proposed alignments for convenient deployment and return of vehicles before and after service hours.

The use of LNG buses may increase the cost of upgrading MSF sites. Separate fuel tanks and safety measures are required to store the natural gas fuel used in the buses. Depending upon land availability and the infrastructure of the existing MSFs, new facilities may be required to accommodate the LNG infrastructure.

1.4.8 Other Transit Vehicle Technologies

There are several other transit vehicle technologies which are in various stages of implementation in North America. Further analysis of the technologies and travel corridors will determine if some of these technologies are appropriate for implementation in the MAG region. The vehicle technology discussed in this section is the Diesel Multiple Unit (DMU).

Diesel Multiple Units

This vehicle technology has been implemented and is now operational in the Canadian capital city of Ottawa. The "O-Train," as it is called, operates in an 8 kilometer (4.97 mile) alignment on an abandoned freight rail line. The diesel cars are streamlined with a very modern look, and are low-emission vehicles to reduce the impacts caused to air quality. Passenger cars carry up to 135 seated passengers, with a total capacity of over 200 passengers including standing room areas. Cars can operate in variable length trains as required.

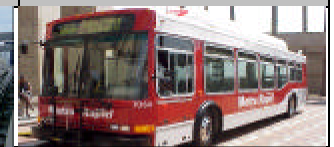
This technology is appropriate for implementation in place of traditional electric-powered light rail and commuter rail systems. When compared to light rail, the DMU cars, as they are named, could have a lower implementation cost because no electrical power infrastructure is required. Visual and aesthetic impacts are also reduced due to the absence of overhead catenary wires. Smaller DMUs could cost less to purchase and maintain than larger commuter rail locomotives and passenger cars, making DMUs a cost-effective alternative in areas which cannot support commuter rail operations. The vehicles are capable of operating in traditional rail corridors or within the right-of-way of arterial streets.

Some limitations are present with this technology. Currently available DMUs do not meet current Federal Railroad Administration (FRA) safety standards for operation with freight rail traffic. Efforts are being made by the Long Island Rail Road to design and implement a DMU which complies with all FRA safety standards. The Ottawa O-Train is not compliant. However this system does currently operate in an active freight rail corridor. The operational hours of the O-Train and freight rail traffic are staggered to prevent simultaneous operations. Freight traffic is permitted to operate between midnight and six a.m. when passenger service is not offered. As FRA compliant designs are developed and implemented, the deployment of this technology may become more feasible in more parts of North America.

Summary of High Capacity Transit Services

Table 1.4-3 presents of summary of the high capacity transit services described above. Information provided in the table includes descriptions of the advantages and limitations of each technology, passenger capacity, and frequency of service.

Table 1.4-3 Summary of High-Capacity Transit Alternatives

Attribute	Commuter Rail	Heavy Rail	Light Rail Transit	Automated Guideway Transit	Bus Rapid Transit
					
Peak Period Headway	10 to 60 minutes	2 to 10 minutes	5 to 10 minutes	2 to 10 minutes	2 to 10 minutes
Distance Between Stations	2 to 10 miles	0.25 to 2 miles	0.25 to 1 mile	0.25 to 1 mile	0.25 to 5 miles
Vehicle Type	Locomotive with single or bi-level cars or multiple unit cars	Single level cars	Single level LRT cars	Single level cars attached in pairs	40 to 60 foot single compartment or articulated buses
Capital Cost per Mile	\$2 million to \$25 million	\$50 million to \$100 million (elevated) \$150 million to \$250 million (subway)	\$25 million to \$50 million (at-grade) \$50 million to \$75 million (elevated)	\$50 million to \$100 million	\$0.5 million to \$6 million (Express bus) \$0.5 million to \$2 million (BRT Lite) \$8 million to \$14 million (BRT busway)
Average Passenger Capacity per Vehicle	100 to 200 passengers	200 passengers	50 to 150 passengers	50 to 100 passengers (regional service) 10 to 50 passengers (locational services)	40 to 100 passengers
Passenger Capacity per Hour	4,000 to 10,000 passengers	12,000 to 30,000 passengers	5,000 to 10,00 passengers	5,000 to 10,000 passengers (regional) 1,000 to 5,000 passengers (locational)	1,000 to 2,000 passengers (express bus) 3,000 to 7,000 passengers (BRT Lite, busway)
Power Source	Diesel locomotives or overhead eletric power	Electrified 3rd rail	Overhead electric wires	Electric	Diesel or LNG bus
Technology Advantages	Proven technology High speed service	Can transport high number of riders Frequent service	Most flexible rail technology Lower cost than heavy rail	No driver required Frequent service Can meet demand of passenger surges	Lowest capital cost Most flexible to expand and change alignments
System Limitations	Can only operate in rail corridors All day operations costly	Must be grade separated Needs large passenger base to be cost-effective	May require arterial street widening	Must be grade separated	May require arterial street widening

1.4.9 Impact of User Amenities on Transit Ridership

The Federal Transit Administration (FTA) has researched the impacts of improved rider amenities upon transit ridership and the public's opinion of transit services as efficient and viable transportation alternatives. A report produced by the Transportation Research Board (TRB) for the FTA in 1999 examined the influence of user amenities on ridership and ways for local transit providers to select the correct amenities to meet the needs of their ridership base. Improved amenities were found to create a more positive view of transit services and attract new transit riders. However, the functionality of amenities was as important as the presence of the amenities. Poorly designed or unneeded amenities were seen more as a waste of money than as system improvements. The type of amenities most likely to attract riders varies depending upon the type of rider utilizing the service, the length of wait time for vehicles, average passenger trip length, and the environmental characteristics of the region. This section will examine to the types of amenities available at transit centers and stations, and the amenities available on the various types of transit vehicles capable of providing high capacity transit service.

Amenities which seem like unnecessary frills or preferential treatments now can become essential features as time progresses. The presence of air conditioning and heating systems in vehicles used to be rare occurrences. These features are now standard on all vehicles and their absence would seem unfathomable today. Low-floor buses and power outlets on trains are becoming essential characteristics for current transit vehicles. In some cases these amenities are required by the local transit authorities. Policies in the MAG region require low floor buses in order to meet the Americans with Disabilities Act (ADA) requirements.

The environment of a region will also influence the desired types of amenities. Riders in cold climates will request heating systems and shelters at rail platforms and bus stops. Misting mechanisms are useful in hot climates such as the MAG region. Security and safety can be more important than comfort for some riders. Features such as lighting and surveillance cameras make transit riders fell safer and secure. Cleanliness is also essential. A well-maintained station or vehicle free of litter and vandalism presents the appearance that someone is responsible for the area. Bright, clean stations and vehicles will be perceived as safer than poor-lit rundown stations, even if crime levels are the same at each location.

Improvements mandated by the ADA are usually appreciated by all transit riders and can improve the overall operation of transit vehicles. Low-floor buses and other vehicles enable the disabled and seniors to board buses quickly and without the aid of wheelchair lifts. These buses also increase the speed of all passengers boarding and alighting, reducing vehicle dwell times at stops and stations, and improving system travel times.

Station Amenities

Based upon the research done by the TRB, commuters' desire for amenities at transit stations varies depending upon the amount of time commuters expect to wait at the station for the next transit vehicle. More amenities were requested by riders who have longer waits between trains or buses. The types of amenities which improve the conditions for longer wait periods include a covered shelter or indoor waiting area, cooling and heating systems, comfortable seating, and good lighting indoors and outdoors. Commuter rail and express bus services are the high capacity transit modes most likely to have long wait times between vehicles. Commuter rail stations will typically have the greatest amount of amenities as a result of the longer station wait times. Many stations in Los Angeles Metrolink commuter rail network offer restrooms, indoor waiting areas, and small cafes for waiting riders.

Heavy rail, LRT, AGT, and BRT stations usually do not always provide the same level of amenities present at commuter rail stations. These forms of high capacity transit systems provide more frequent service, with two to 15 minute headways, making station wait times for riders less. Stations for these transit systems typically consist of a concrete platform with shelters, lighting, benches, and trash receptacles. Heating and cooling systems may be present depending upon the climate of the region. The shorter wait times for riders at these stations reduce the need for additional amenities. Most riders would not be able to utilize and enjoy the same amenities offered at commuter rail station without missing their train.

Station amenities are usually also tailored to the type of rider using the transit system. Long distance transit services such as commuter rail and express bus typically have higher costs for riders due to the extra distance traveled. Riders who are paying more for services may expect more amenities to be present to give the appearance that they are receiving a greater benefit for their extra investment. Likewise, riders who pay lower fares and commute using short trips usually expect fewer amenities beyond those considered to be basic features.

Transit Vehicle Amenities

The amenities and features found on high capacity transit vehicles can improve the perception potential riders have about the quality of service provided. Similar to the patterns for station amenities, vehicle amenities can vary depending upon the average trip length for riders and the type of riders using the service.

Long distance trips necessitate a certain set of amenities which should be provided for riders. Most commuter rail vehicles offer upholstered seats with high backs, restrooms, and large windows for passengers to view the passing scenery. Riders may also be attracted by the presence of power outlets for laptop computers and desk workspaces. These amenities can allow riders to be more productive with their commute time. The new Sounder commuter rail service in Seattle offers many of these amenities in an effort to attract riders to the new service. The bi-level passenger cars used for this service provide luggage racks above seats to store briefcases and bags, work tables equipped with electrical outlets, and high-back cloth seats with cup holders.

On board amenities for other high capacity transit vehicles providing shorter distance trips are equally important. Interior improvements include better lighting, larger windows, and upholstered seats. Innovative exterior designs are also helpful in attracting riders. Both vintage and futuristic designs can attract riders to try the transit system. Vintage vehicles present an opportunity to connect with the past and make riders feel nostalgic. Futuristic designs imply speed and fast service, attracting riders who want to travel and reach their destinations quickly and on time.

Adding specialized amenities to attract potential transit riders from certain segments of the population can also be important. The presence of bicycle racks on buses and storage areas on trains makes transit services more appealing to bicyclists and may encourage more people to use bicycles so that they can use transit. Maricopa's own Valley Metro was the first transit agency in the United States to install bicycle racks on the exterior of its buses.

Amenities selected to be available for users of the recommended high capacity transit services in the MAG region should be designed to meet the profiles and needs of the projected system users. The variety of recommended types of transit services will lead to a variety of different amenities which will need to be provided to transit riders.